OFFICIAL PUBLICATION OF THE PROCEEDINGS AMERICAN ASSOCIATION OF TEXTILE CHEMISTS AND COLORISTS

AUGUST 22, 1949
VOLUME 38, NO. 17

AMERICAN DYESTUFF REPORTER

DEVOTED TO TEXTILE CHEMISTRY · BLEACHING · DYEING · PRINTING · FINISHING

BACCHANTE RED
HAITI RED
RED PEPPERMINT
TROPEZ

Bright reds for ladies' wear — woolens, worsteds and unions — are running heavily for the Fall and are indicated by the stylists for the Spring of 1950.

For the production of those reds Geigy recommends its six Polar Brilliant Reds ranging from the yellow shade to the blue.

Startling in their brilliance; of good fastness to light, milling and light fulling; effective in neutral, acid or chrome dyeing, they simply should not be overlooked when running, Bacchante, Haiti, Red Peppermint, Tropez or variations thereof.

Geigy
Dyestuff Makers Since 1859

GEIGY COMPANY, Inc.
89-91 BARCLAY STREET, NEW YORK 8, NEW YORK

BRANCH OFFICES: Boston • Charlotte, N. C. • Chicago • Los Angeles • Philadelphia
Portland, Ore. • Providence • Toronto
IN GREAT BRITAIN: The Geigy Co., Ltd., National Buildings, Parsonage, Manchester

Liquid

HYDRALDEHYDE

The Name to Remember When Buying Stripping Agents

Outselling all others since its origin twenty years ago — it is *today* the woolen industry's *safe* stripper. Our constant efforts to eliminate free zinc in *liquid* HYDRALDEHYDE through modern manufacturing methods assure stronger fibres in reworked wool and piece goods.

Test *liquid* HYDRALDEHYDE against any other stripping agent offered — either powder or liquid — for a true comparison of the fibre's breaking strength.

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261 FRANKLIN STREET BOSTON, MASS.

FACTORY · LOWELL JUNCTION · MASS.

A Textile Utility
Product of
Wide Application

Stabilon*

for NAPTHOL dyeing and printing

Reduces crocking and brightens Napthol shades by stabilizing Fast Color Salts and Bases.

Prevents premature decomposition of stock feeder solutions and print pastes.

Another of the A.A.P. range of superior textile auxiliaries. For detailed information regarding your own particular requirements consult our nearest branch. A.A.P. technicians are always happy to be of service.

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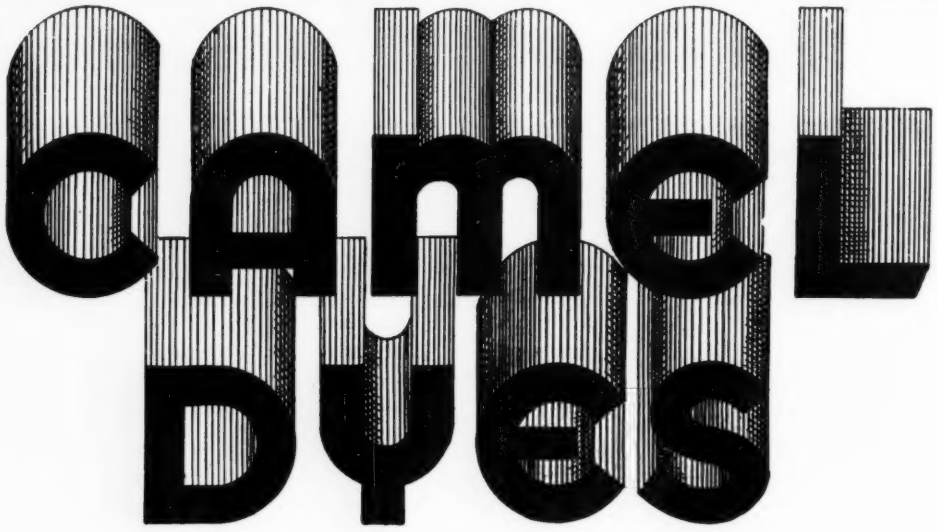
Branches: Boston, Mass. • Providence, R. I. • Philadelphia, Pa. • Charlotte, N. C. • Chicago, Ill. • Los Angeles, Cal.
Chattanooga, Tenn. • **Dominion Anilines & Chemicals Ltd.** • Toronto, Canada • Montreal, Canada

*Reg U. S. Pat. Off.



THE CAMEL LINE OF
DEPENDABLE DYESTUFFS
has served the textile mills of America
without interruption since
1876.

This broad experience assures
PROMPT • EFFICIENT • ECONOMICAL SERVICE
TO MEET ALL DYESTUFF REQUIREMENTS

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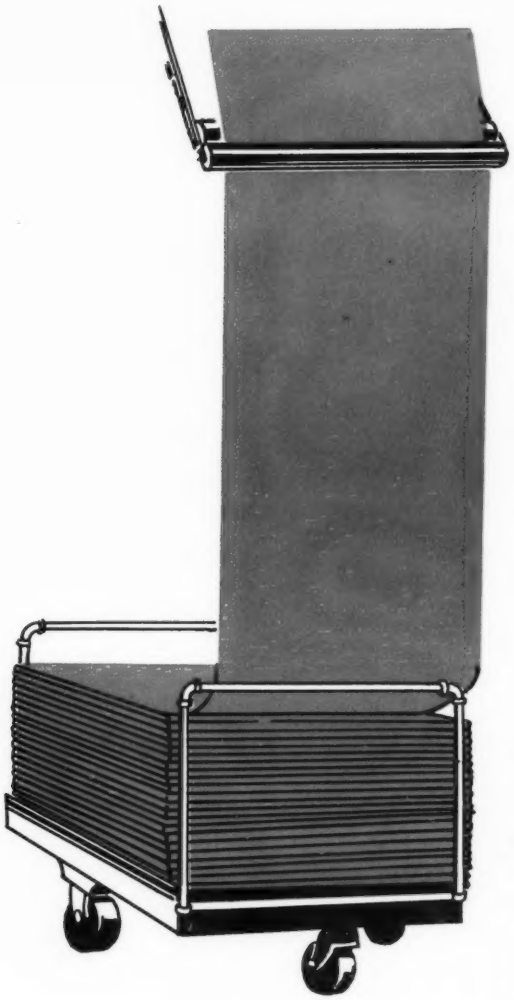


SANTOMERSE No. 1

Monsanto's versatile detergent and wetting agent for high-speed, continuous dyeing

Santomerse No. 1 gives you the detergency and penetration you need for efficiency in your high-speed, continuous dyeing operations. It makes important contributions to level dyeing and non-crocking.

Santomerse No. 1 serves in the reducing, oxidizing and scouring operations in the continuous range. In the various units, Santomerse No. 1 proves exceptionally efficient because it is effective in acid, neutral or alkaline solutions... because it penetrates thoroughly... because it lifts out particles and holds them in suspension for easy rinsing.

For further information on Santomerse No. 1, or other Monsanto detergents and wetting agents, mail the coupon, contact the nearest Monsanto Sales Office or write: MONSANTO CHEMICAL COMPANY, Desk H, Phosphate Division, 1779 South Second Street, St. Louis 4, Missouri.

MONSANTO SYNTHETIC DETERGENTS AND WETTING AGENTS

Santomerse* No. 1
Santomerse No. 3
Santomerse No. 3 (Paste)
Santomerse 30X
Santomerse D
Santomerse S
Sterox* CD
Sterox SE
Sterox SK
Sterox 5
Sterox 6

**Reg. U. S. Pat. Off.*

Sterox No. 6, one of Monsanto's liquid nonionic synthetic detergents, can be used successfully in preparing goods for the pad box. Sterox is dried into the fabric before it gets to the pad, resulting in quick, even dye penetration.

Synergistic Action Steps Up Detergency and Lowers Costs

Monsanto Tetra Sodium Pyrophosphate, used with either Santomerse No. 1 or Sterox No. 6, creates synergism which increases detergency and lowers costs. Synergistic action is the result of two products working together to give detergency greater than the average of the two used alone... greater than the detergency of either. It is more economical because of this extra cleaning power and because TSPP is lower in price than either economical Santomerse or Sterox.

DISTRICT SALES OFFICES: Birmingham, Boston, Charlotte, Chicago, Cincinnati, Cleveland, Detroit, Los Angeles, New York, Philadelphia, Portland, Ore., San Francisco, Seattle. In Canada, Monsanto (Canada) Ltd., Montreal.

MONSANTO CHEMICALS

MONSANTO CHEMICAL COMPANY
Desk H, Phosphate Division
1779H South Second Street, St. Louis 4, Missouri
Please send items checked: Data and quotations on ___Santomerse No. 1; ___Sterox No. 6; ___TSPP.

Name_____ Title_____
Company_____
Street_____
City_____ Zone_____ State_____

SERVING INDUSTRY... WHICH SERVES MANKIND

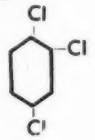
Hooker Chlorobenzenes Available for Prompt Shipment

Hooker manufactures five chlorobenzenes, principal of which are monochlorobenzene and paradichlorobenzene. These products are of exceptionally high quality to insure the best performance in your applications.

If you are not yet familiar with Hooker quality and service, we invite you to test these materials. Literature and samples are available when requested on your business letterhead.

1, 2, 4-TRICHLOROBENZENE
Tech.

$C_6H_3Cl_3$



DESCRIPTION:
Clear, almost colorless mobile liquid having a characteristic chlorobenzene odor. Completely miscible with most organic solvents; practically immiscible in water.

PHYSICAL DATA:

Mol. Wt.	181.5
F. P.	10° C
Dist. R.	205° to 235° C
Sp. Gr., 15.5°/15.5° C	1.465 ± .003
R. I., n20/D	1.570 ± .002
Flash Point	118° C

USES:
As an insecticide, it is particularly effective as a soil poison in termite eradication; solvent for fats, oils, waxes, resins; as a heat transfer medium; in chemical synthesis for manufacture of dye intermediates and other organic chemicals.

PARADICHLOROBENZENE
(1, 4-dichlorobenzene)

$C_6H_4Cl_2$

DESCRIPTION:
White to clear, transparent crystals with a pleasant aromatic odor. Soluble in most organic solvents; insoluble in water. Available in seven regular sizes.

PHYSICAL DATA:

Mol. Wt.	147
M. P.	53° C
B. P.	173° C
Flash Point	73° C
Fire Point	108° C

USES:
Recommended and widely accepted as a highly effective insecticide for agricultural and domestic purposes in control of: peach tree borer, black peach aphids, tobacco blue mold, clothes moths, carpet beetles, fish moths, garden centipedes, etc. Also used in the manufacture of sanitary specialties such as deodorants. As a chemical intermediate in organic synthesis, it is used in the preparation of a variety of chemicals, especially dyestuffs.

MONOCHLOROBENZENE
(phenyl chloride)

C_6H_5Cl

DESCRIPTION:
Clear, colorless, moderately volatile liquid, with a characteristic mild odor. Completely miscible with most organic solvents; immiscible with water.

PHYSICAL DATA:

Mol. Wt.	112.5
F. P.	−44° C
B. R.	131.3° to 132.3° C
Sp. Gr., 15.5°/15.5° C	1.113 ± .001
R. I., n20/D	1.524
Flash Point	29° C

USES:
Intermediate in manufacture of insecticides, dyestuffs, drugs, perfumes, and other organic chemicals; solvent for paints, varnishes, lacquers; general organic solvent; heat transfer medium for condensing vapor systems.

Technical Data Sheets on the other Hooker Chlorobenzenes: orthodichlorobenzene, hexachlorobenzene, are also available upon request.

From the Salt of the Earth

HOOKER ELECTROCHEMICAL COMPANY

HOOKER CHEMICALS

2 FORTY-SEVENTH ST., NIAGARA FALLS, N. Y.
NEW YORK, N. Y. • WILMINGTON, CALIF. • TACOMA, WASH.

8-826

CAUSTIC SODA • PARADICHLOROBENZENE • MURIATIC ACID • CHLORINE • SODIUM SULFIDE • SODIUM SULFHYDRATE

It's Thrifty to Use TRITON X-100 in Textile Wet Processing

Be wise and thrifty. Write today for full details of this low cost, versatile surface-active agent—TRITON X-100.

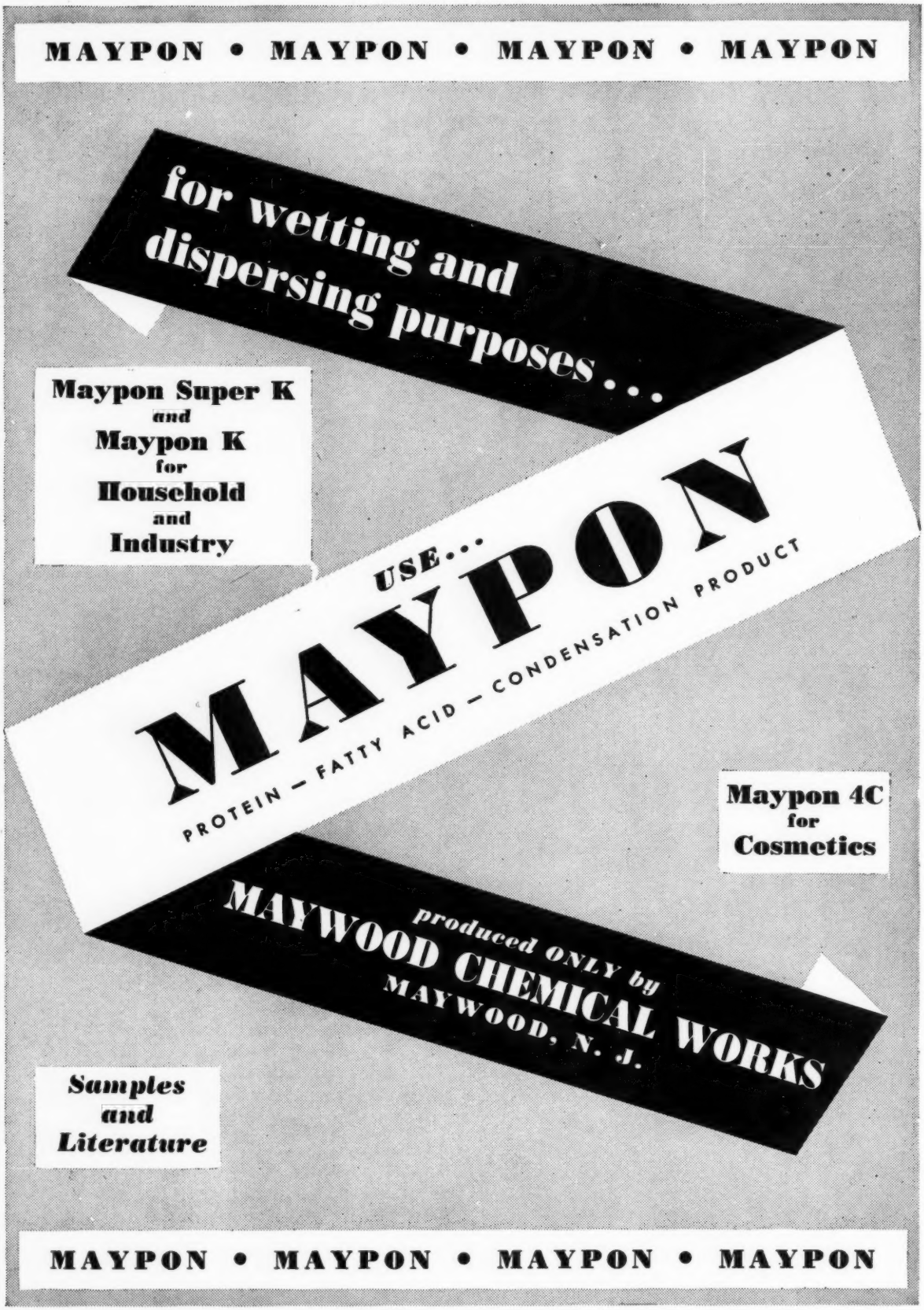
CHEMICALS FOR INDUSTRY

ROHM & HAAS COMPANY

WASHINGTON SQUARE, PHILADELPHIA 5, PA.

Representatives in principal foreign countries

TRITON X-100 is a trade mark, Reg. U. S. Pat. Off and in principal foreign countries.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for wetting and dispersing purposes . . .
Maypon Super K
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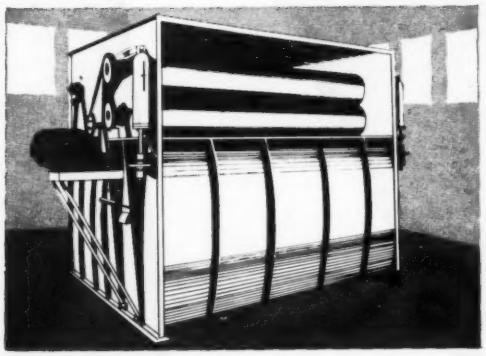

1/3 faster wool piece-goods scouring

add 3% to 4% Nacconol* NR

AMERICA'S LEADING SYNTHETIC DETERGENT

with Sodium Chloride or Bicarbonate**

get

Cleaner free-rinsing goods
Complete removal of lubricating oils
30% to 50% faster scouring at lower temperature
20% to 30% lower costs

Prompt service from ample basic production Get in touch with our nearest office.

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40 RECTOR STREET, NEW YORK 6, N. Y. (BOwling Green 9-2240)

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Chicago 10, Ill., 357 West Erie St.	SUperior 7-3387	Chattanooga 2, Tenn., James Building	CHattanooga 6-6347
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*Reg. U. S. Pat. Off.

**Write for full details on this effective use of NACCONOL NR.

Just imagine that you're holding a glass of crystal clear spring water up to the sun. Why? That's the quickest way to describe CLEARFILM—a crystal clear sizing and finishing gum for rayons and mercerized cottons.

crystal clear as spring water

CLEARFILM is an outstanding specialty developed by National. It gelatinizes readily in hot water and can be applied at normal temperature. The result? Always a crystal clear solution . . . an equally clear film on any textile fabric . . . lustrous, often brightened colors . . . uniformly maintained shades.

Photo courtesy of:
AMERICAN VISCOSE CO.

CLEARFILM—which is just as effective but less expensive than gum arabic and gelatin—is ideal for dyeing and finishing in the same operation. And it's an excellent extender for many synthetic resin finishes. Write for a test sample.

National also produces the following *starches—and specialties with easily demonstrated superiority:* AMBERTEX a heavy-bodied thickener for white discharge, rapidogen and vat color printing; FLOTEX to replace natural gums for printing; TABLE ADHESIVE for screen printing; FLOCK ADHESIVE 970 for chenille flock printing; HOOSIER PEARL CORN STARCH . . . THIN BOILING CORN STARCH . . . CHLORINATED CORN STARCH . . . and DEXTRINES.

Address: 270 Madison Ave., New York 16, Boston, Philadelphia, Atlanta, New Orleans, Indianapolis, Chicago, San Francisco, and other principal cities. *In Canada:* National Adhesives (Canada), Ltd., Toronto and Montreal. *In Holland:* National Z.I., Veendam.

National
STARCH PRODUCTS

clearfilm

A SIZING AND FINISHING GUM FOR RAYON AND COTTON

FROM SKI SUITS

TO BEACHWEAR

Nothing takes the place of Glycerine

Modern textiles are built to stand up in every type of climate. And there's hardly a phase of modern textile processing that doesn't benefit from one or more of the many unusual properties of—GLYCERINE.

As a hygroscopic agent and softener, glycerine is a standard ingredient of sizing compositions. As a penetrating agent, dispersant, and thickener, glycerine is used extensively in printing pastes. As a chemical intermediate, it's a favorite in the preparation of those alkyd resins which are helping to make possible today's wind- and water-resistant fabrics, anti-mold and rot-proof garments.

Glycerine's combination of physical and chemical properties can be matched by no other product. That's why in the textile industry—or in almost any industry—*Nothing takes the place of glycerine!*

GLYCERINE PRODUCERS' ASSOCIATION
295 Madison Avenue
NEW YORK 17, N. Y.

Technical GLYCERINE NEWS

GLYCERINE SECTIONS OF BEILSTEIN TRANSLATED! Now available for the first time, an English translation of the Glycerine Sections of Beilstein's famous *Handbuch der Organischen Chemie* (4th Edition). Complete in *one* volume entitled "GLYCERINE AND SOME GLYCERINE DERIVATIVES." Publication authorized by the Attorney General of the United States. Compiled and edited by Dr. R. N. Du Puis, Dr. C. S. Miner, Jr. and J. B. Segur—long acknowledged as authorities in the field of Glycerine and its properties. Amassed in its 210 pages are an unusually large number of Glycerine derivatives with extensive cross-references. Also included are a complete table of contents and a detailed index of the derivatives and fatty acid esters of Glycerine. A timely, comprehensive volume for your chemical reference library. Order from the Glycerine Producers' Association enclosing $2.50 (check or money order) for each copy.

★ ★ ★

TO INCREASE TEXTILE PRINTING SPEEDS and thereby reduce costs, a high concentration of solvent in the printing paste is recommended according to a report presented before a leading textile association. For nylon and acetate rayon printing with acetate colors, a glycerine-containing formula is claimed to be most efficient. (T-12)

★ ★ ★

SUPERIOR "OILED-SILK" FABRICS can be made by replacing linseed oil with alkyd resins. Such products form clear, colorless films which do not yellow on aging and are free of objectionable odors, it is claimed. (T-13)

★ ★ ★

GLYCERINE VISCOSITIES TABLE AVAILABLE. The Research Laboratories of the Glycerine Producers' Association program of glycerine research, has prepared a table of viscosities of glycerine in aqueous solution from 0 to 100 per cent, at from 0 to 100 degrees C. To obtain your copy, check T-14 on the coupon below. (T-14)

GLYCERINE PRODUCERS' ASSOCIATION, DEPT. 13
295 MADISON AVENUE
NEW YORK 17, N. Y.

I should like to know the source of the items appearing in Technical Glycerine News which I have checked below.

☐ T-12 ☐ T-13 ☐ T-14

NAME.....

COMPANY.....

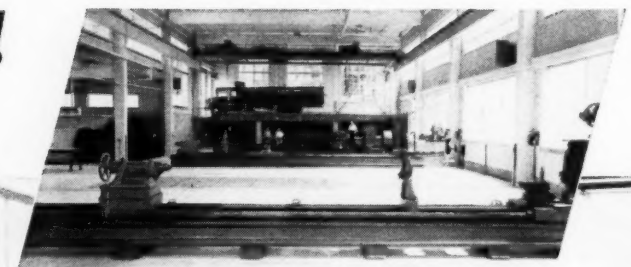
ADDRESS.....

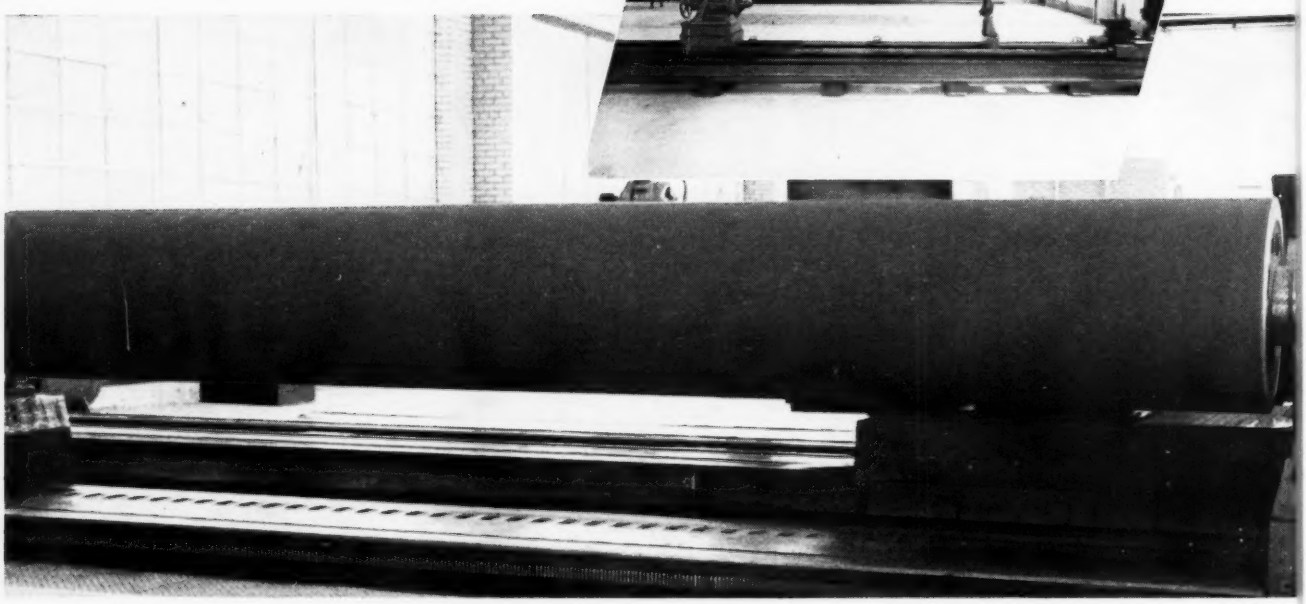
There's a NEW LOOK

at Rubber Roll Headquarters!

Above: Exterior of new Ward plant addition at Stowe-Woodward, Inc.

Below: A section of the interior looking toward elevated loading platform. Farrel Grinder in rear, lathes in foreground, vulcanizers at left.





New 42′ 3″ Farrel Rubber Roll Grinder, LARGEST AND LONGEST OF ITS TYPE IN THE U.S.A.

You're looking at Stowe-Woodward's new Ward plant addition . . . built and equipped for the single purpose of making the finest rubber covered rolls to your most exacting requirements. Here you will find the tools, the will, and the skill that have justly made Stowe-Woodward the place to turn when quality is basic, service is urgent, or a new rubber roll development must be pioneered.

Typical of the new equipment is the Farrel Roll Grinder which will grind and crown rubber rolls 60″ diameter by over 300″ width of face with tolerances held to .0005″. This grinder and other new facilities symbolize our determination to serve you even better in the days ahead.

STOWE-WOODWARD, INC.

Craftsmen in rubber

NEWTON UPPER FALLS 64, MASSACHUSETTS

for light-fast dyeing of acetate yarn and nylon

FAST VIOLET 5RLF

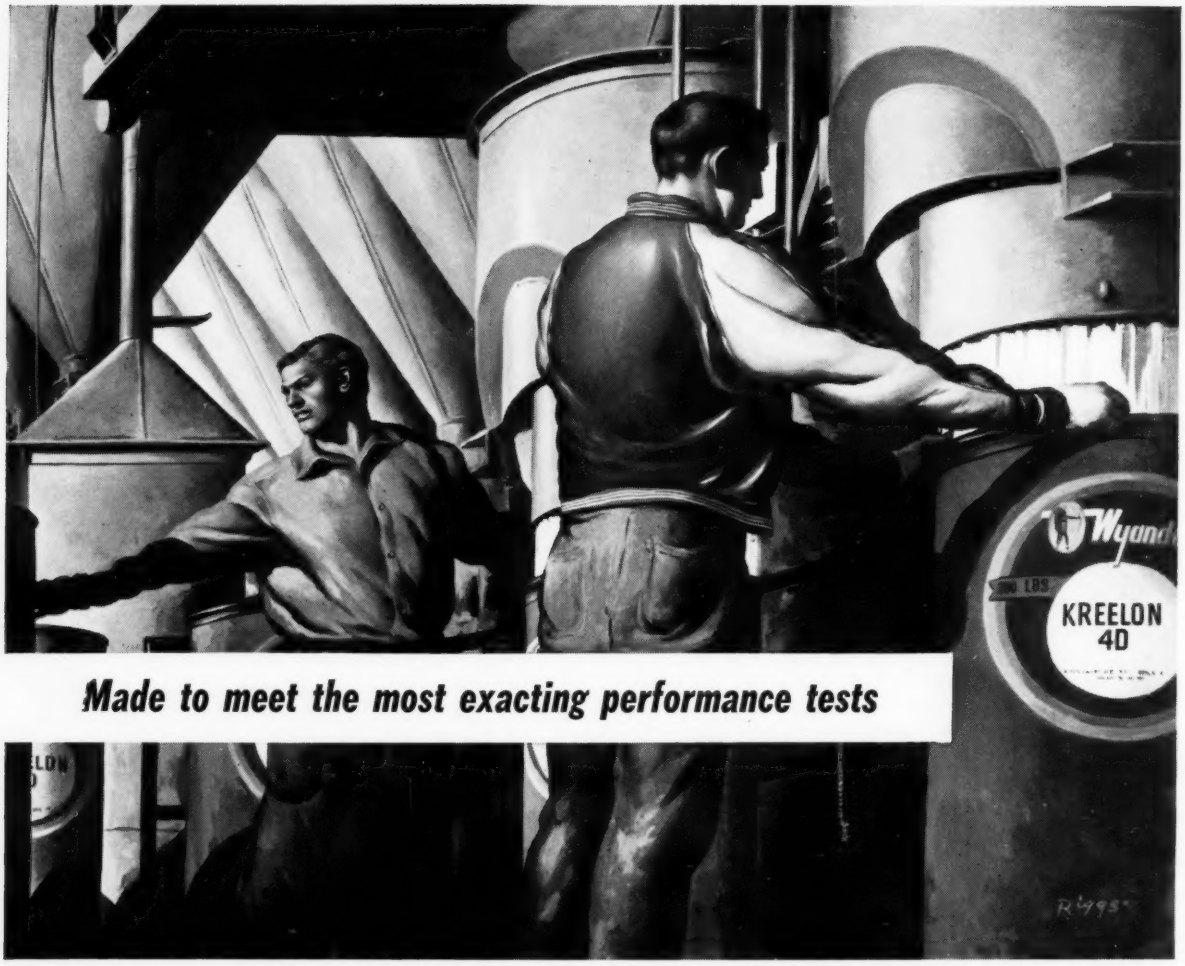
Eastman Fast Violet 5RLF, an anthraquinone dyestuff, is one in a line of colors with exceptional fastness to sunlight. On acetate yarn, this dyestuff produces a bright, clear red violet; pastel shades have twenty-five to forty hour light-fastness. It dyes nylon a somewhat bluer shade, and is one of the best acetate dyes for producing light-fast shades on nylon.

Eastman Fast Violet 5RLF dyes at temperatures ranging from 160°F to 190°F. It exhausts rapidly and levels well, and it is recommended for either jig or box dyeing.

The LF series to which this dye belongs is part of a wide variety of Eastman Acetate Dyestuffs for the dyeing of acetate fibers and the fabrics in which they are used. Additional information on their application can be obtained by writing to Tennessee Eastman Corporation (Subsidiary of Eastman Kodak Company), Kingsport, Tennessee.

Eastman Acetate Dyestuffs

• Eastman Acetate Dyestuffs are sold in the United States through Tennessee Eastman Corporation in Kingsport, Tennessee, and Lodi, N. J.; in Canada, through Clough Dyestuff Company Ltd., 33 St. Mathieu Street, St. Laurent, Quebec.



Made to meet the most exacting performance tests

Here you see the conveyor line and the great, looming storage bins of the new Synthetic Detergent Plant at Wyandotte

WYANDOTTE KREELON—*the white, uniform detergent and wetting agent*

If you produce cleaning compounds or other products that call for an effective synthetic organic detergent, you'll find the answer in *Wyandotte Kreelon**. Or if some operation in your plant requires an unusual amount of time and labor in the wetting-out process, chances are that Kreelon can help you do a *better job, faster.*

This versatile chemical, broadly classified as a surface-active agent, is designed to meet rigid performance specifications. Initial production of Kreelon was delayed for months until the product's color, chemical analysis and performance measured up to the highest standards. Controlled production maintains these standards.

The three grades of Kreelon produced range from *white* to *light cream* in color and have only a faint characteristic odor. Equally important is the fact that they retain their wetting, sudsing and cleansing properties in acid, alkaline or neutral solutions — in hard or soft waters.

Wyandotte Kreelon is readily available and economically priced. Complete information on its properties and suggested uses will be furnished at your request. In addition, our experienced technical staff stands ready to assist you in solving many detergency problems.

**Registered trade-mark*

Wyandotte Chemicals Corporation
Wyandotte, Mich. • *Offices in Principal Cities*

SODA ASH • CAUSTIC SODA
BICARBONATE OF SODA
CALCIUM CARBONATE • CALCIUM CHLORIDE
CHLORINE • HYDROGEN • DRY ICE
SYNTHETIC DETERGENTS • GLYCOLS
CARBOSE (Sodium CMC) • ETHYLENE DICHLORIDE
PROPYLENE DICHLORIDE • CHLOROETHERS
AROMATIC SULFONIC ACID DERIVATIVES
OTHER ORGANIC AND INORGANIC CHEMICALS

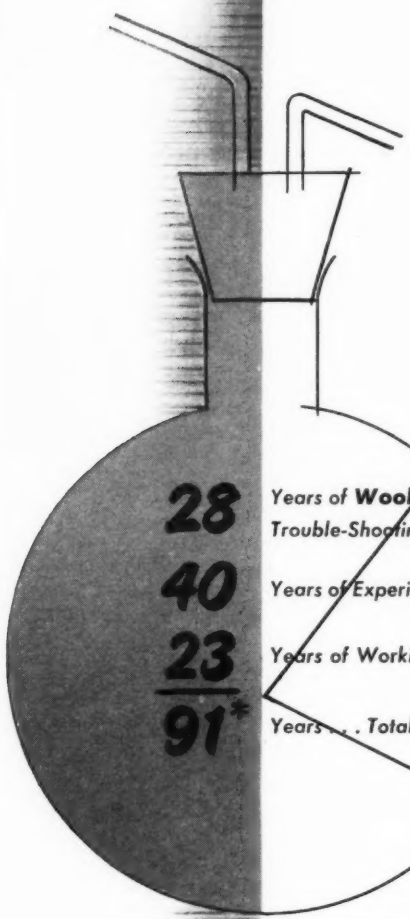
Wyandotte
REG. U. S. PAT. OFF.

—Got a Textile Chemical Problem?

91*

YEARS say—

"MAYBE we have the answer!"



28 Years of **Woolen** and **Worsted** Trouble-Shooting!

40 Years of Experience with **Silks** and **Rayons!**

23 Years of Working with **Cotton!**

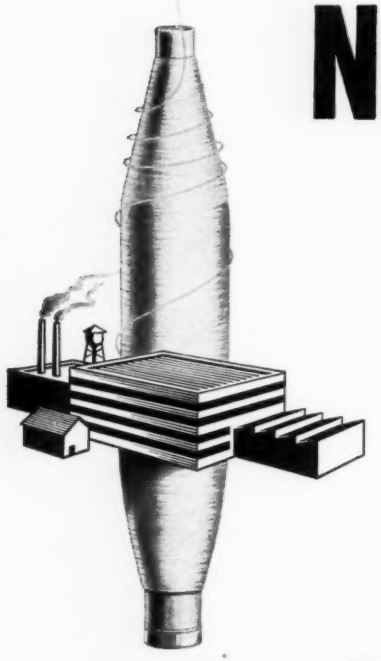
91* Years . . . Total experience of our experts!

There is only one real test for any service . . . that's a fair trial! Give us this test with your next textile chemical problem, large or small . . . We'll rest our case on our answers!

ATLANTIC CHEMICAL CO., INC.
CENTREDALE, RHODE ISLAND
Exclusive Eastern Distributors of
Reichhold Fabrez Synthetic Resins

if your business hangs on this...

NOPCO* 1656-R *is a must*



And by "this" we mean WORSTED yarn. Here we can represent it only as a line . . . but, as you know, it's a line full of significance. For top quality WORSTED yarns, economically produced, mean enduring customer satisfaction, increased sales, greater profit.

And that's where Nopco's NEW 1656-R fits right into your WORSTED production picture. For here's an oil specially formulated to *assure more efficient processing . . . superior quality finished goods.*

You will find Nopco 1656-R:

ELIMINATES static

ELIMINATES oxidation

ELIMINATES *75%* of soap costs (and, by scouring out freely, assures clearer, brighter dyeing)

MINIMIZES broken ends

In a word, Nopco's NEW 1656-R enables the worsted manufacturer to achieve *outstanding results*—comparable to those obtained by users of famous Nopco FUA wool oil in carding, spinning and finishing woolens.

Write us today, and profit by getting all the facts about NEW Nopco 1656-R . . . the remarkable modern aid to better WORSTED production.

New!

NOPCO 1656-R for better WORSTED production

*T. M. Reg. U. S. Pat. Off.

NOPCO® EVOLVED THRU RESEARCH

NOPCO CHEMICAL COMPANY

Formerly National Oil Products Company

HARRISON, NEW JERSEY

Branches: Boston • Chicago • Cedartown, Ga. Richmond, Calif.

a new type cation active compound

PERMA PAR ACA-100

100% ACTIVE • 100% SOLIDS

applicable to all fabrics

PERMA PAR ACA-100 is a fatty acid-amine condensate containing no water or inert material.

Used as a finish it exhausts completely from either a long or short bath.

This product imparts a soft, mellow hand to the fabric with a minimum effect on the shade and luster of dyed colors.

Since it is of an alkaline nature this product can be used as a one bath combination for use on cotton...

PERMA PAR ACA-100 will not oxidize or go rancid either in storage or on the cloth.

Write for complete information

REFINED PRODUCTS CORPORATION

Manufacturing Chemists • LYNDHURST • NEW JERSEY

Manufacturers of PERMA-CIDE, the approved, outstanding, mildewproofing agent

Southern Representative: DYER S. MOSS, 1301 Liberty Life Bldg., Charlotte, North Carolina

New England Representatives: { E. E. LEDOU, 9 Harding Ave., Providence, R. I.
CLARENCE E. MOSS, 19 Wilson Ave., Branford (14), Conn.

California Representative: SIDNEY SPRINGER, 2300 S. Vermont Ave., Los Angeles 7, California

Canadian Selling Agents: Berkeley Products Canada, Ltd., 41 Hillcrest Ave., St. Catharines, Ontario, Canada

Exporting Agents: Chem Cel Company, 82 Wall St., New York City

More readily soluble and more stable, because of its higher SO_3 content, than conventional soaps and sulfonated tallows, Stearo Glyceryl Sulfate N is also much more versatile. It will provide striking improvements in softening and plasticizing, and at the same time can be used for giving body and/or thickness over a wide range of effects. Its penetrating qualities are markedly superior.

Stearo Glyceryl Sulfate N shows much greater resistance to hard water and electrolytes than ordinary softeners, and exhibits exceptional resistance to rancidity and yellowing. It can be used with many other finishes for special hands of extensive variety.

Much more economical to use than ordinary sulfonated tallows, Stearo Glyceryl Sulfate N involves no changes in processes or equipment.

Onyx Technical Data Sheet 12-T carries the complete story of Stearo Glyceryl Sulfate N and its many textile applications. It will pay you to study this data.

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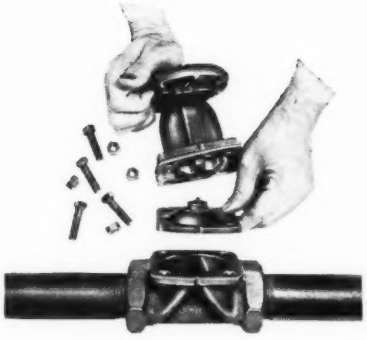

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FABRICS FOR GLASS CURTAINS AND DRAPERIES

HAZEL M. FLETCHER

Textile Physicist, Bureau of Human Nutrition and Home Economics, Agricultural Research Administration, U. S. Department of Agriculture[1]

GLASS curtains and draperies generally are expected to look well and wear well for a period of years. If they are to meet this expectation they must possess certain properties of texture as well as certain draping qualities and hold certain decorative values for the room in which they are to be used. To be specific, textiles from which glass curtains and draperies are made should be colorfast to light and cleaning. Further, they should not shrink or stretch in cleaning and should not deteriorate rapidly during ordinary use.

The manner in which a fabric is finished determines to a large extent its colorfastness and its dimensional stability—that is, whether it will shrink or stretch. For example, cotton cloth may be dyed with a dye colorfast to light and to cleaning; it may be dyed with a fugitive dye which makes it an unsatisfactory drapery material; it may be preshrunk, or it may be left untreated and as a result shrink excessively. Curtains made from untreated fabrics would be too short after they were laundered; those made from preshrunk materials would probably remain the original length throughout their use.

Exposure to light and heat also affects the wearability of glass curtains and drapery materials. Portions of glass curtains exposed to the heat and light of the sun often will be in shreds within a short time whereas unexposed parts of the same curtain will be quite strong after two or three years of service. Studies have shown that the rate at which the curtain goes to pieces when exposed to heat and light varies with the fiber content *(1, 2, 3)*. Hence, information about the varying rates of deterioration of textile materials is of major importance to the homemaker who wishes to buy materials for long-lasting curtains. Information gathered about one fabric made from a specific fiber can be applied in general to all fabrics of the same fiber content. For example, if cotton fabrics are known to deteriorate less rapidly than fabrics of other fiber contents, then each individual cotton fabric will not need to be tested for deterioration as is necessary in order to determine colorfastness and dimensional stability.

Because of the limited information available on the comparative deterioration by heat and light of commonly used materials for glass curtains and draperies, the Bureau of Human Nutrition and Home Economics undertook a study of such degradation rates. Changes in the breaking strength of undyed fabrics and plastic materials and in the amount of light reflected by them on exposure to light and heat are reported here.

Materials Studied

Included in this study by the Bureau were 22 woven, undyed fabrics and 5 colored plastic materials. Each was suitable in weight, texture, and draping qualities for either glass curtains or draperies. The woven materials consisted of 1 glass

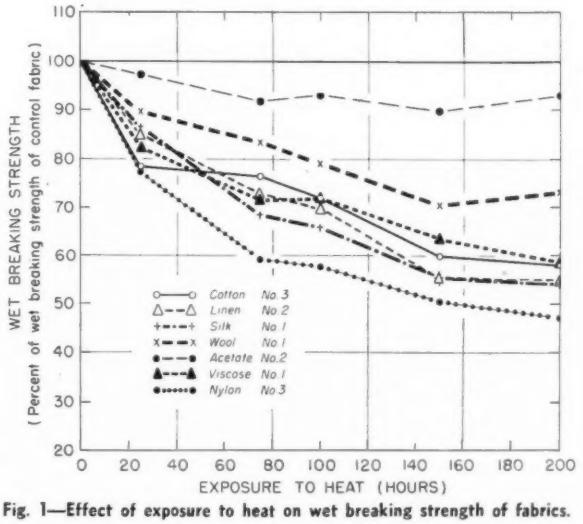

Fig. 1—Effect of exposure to heat on wet breaking strength of fabrics.

[1] Appreciation is expressed to Martha L. Hensley who selected the fabrics and to Jane F. Gilliam and Mary Ellen Duensing for their assistance in the physical measurements of the fabrics.

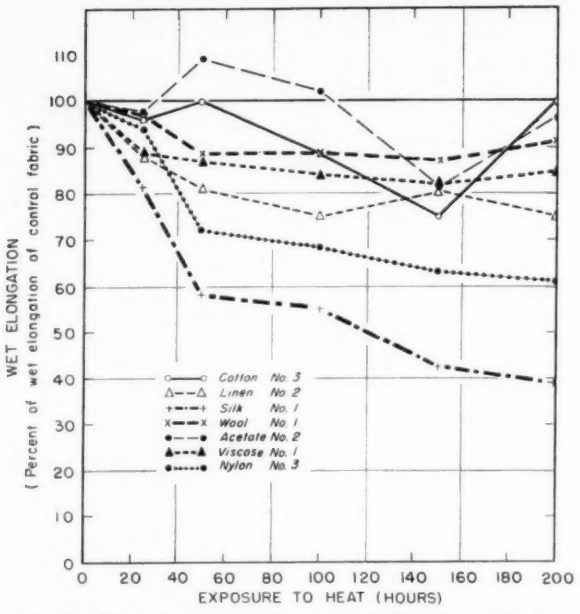

Fig. 2—Effect of exposure to heat on wet elongation of fabrics

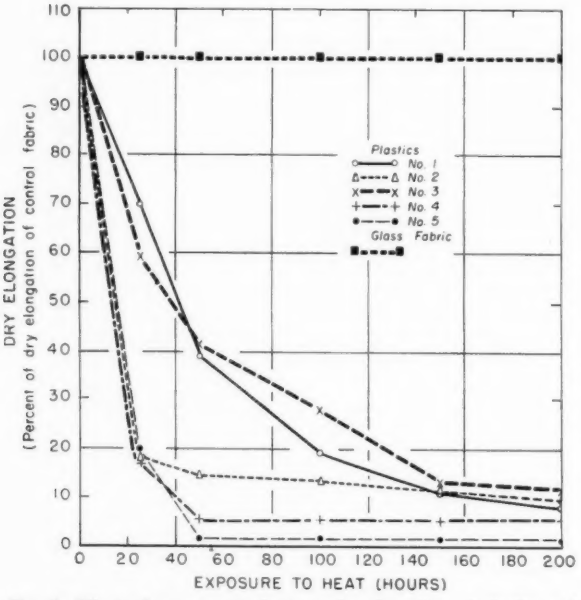

Fig. 4—Effect of exposure to heat on dry elongation of plastics and glass fabric.

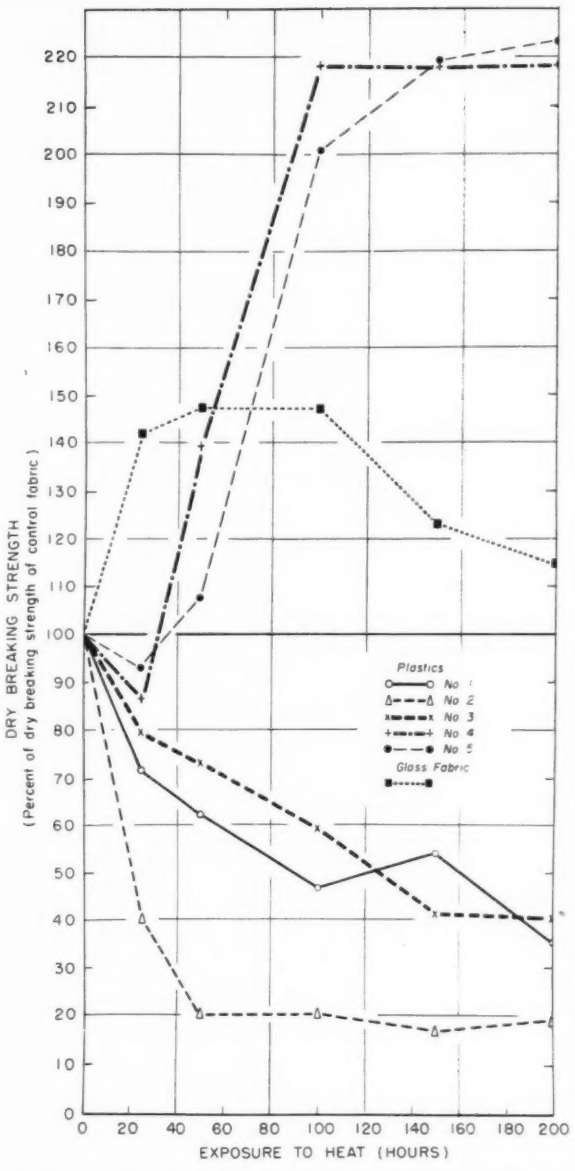

Fig. 3—Effect of exposure to heat on dry breaking strength of plastics and glass fabric.

fabric and 3 fabrics of each of the following fibers:—cotton, linen, silk, wool, acetate rayon, viscose rayon, and nylon. The constructions included marquisette, gauze, crash, and taffeta. Three of the five plastic materials were coated fabrics with woven backgrounds—one of viscose rayon and two of cotton; the other two were plastic films. The description and the physical properties of these materials are reported in table I.

Experimental Procedure

The cotton, linen, silk, wool, acetate rayon, viscose rayon, and nylon fabrics were laundered in order to remove any soluble sizing. They were washed in a revolving cylinder in distilled water at 110° F., with a 0.5 per cent neutral soap solution for one hour. Then they were rinsed three times for 5 minutes each at 110° F. After laundering, the fabrics were placed on curtain stretchers to dry.

Strips of the woven fabrics to be used for breaking strength tests were cut 1¼ inches wide and raveled to a 1-inch width. Strips of the plastic materials to be used for breaking strength tests were cut 1 inch wide. Sets of these specimens were then exposed to heat and light. Each set was made up of 10 warpwise strips of the glass fabric and of the plastics and 20 warpwise strips of each of the other fabrics.

The materials were exposed to heat by

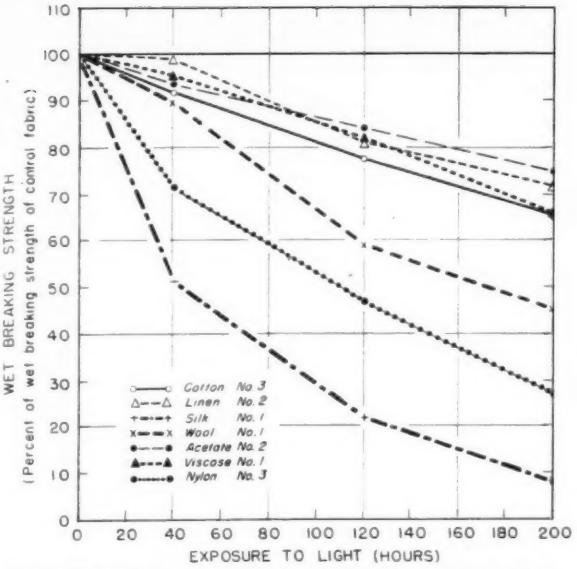

Fig. 5—Effect of exposure to light on wet breaking strength of fabrics.

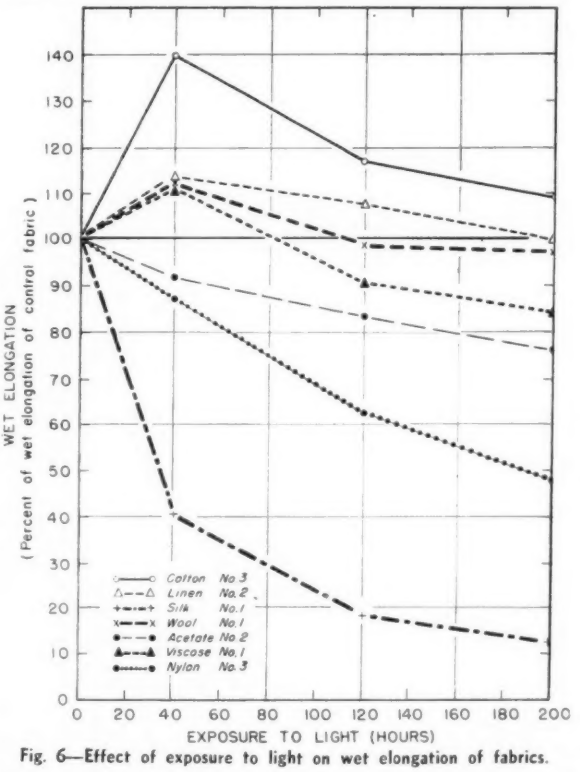

Fig. 6—Effect of exposure to light on wet elongation of fabrics.

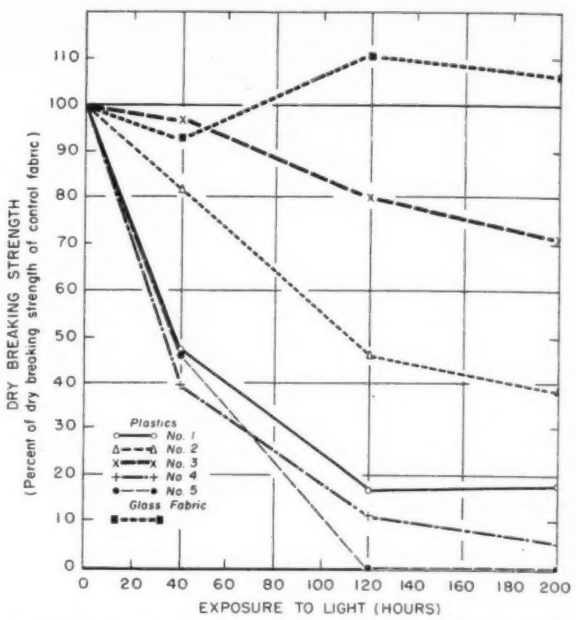

Fig. 7—Effect of exposure to light on dry breaking strength of plastics and glass fabric.

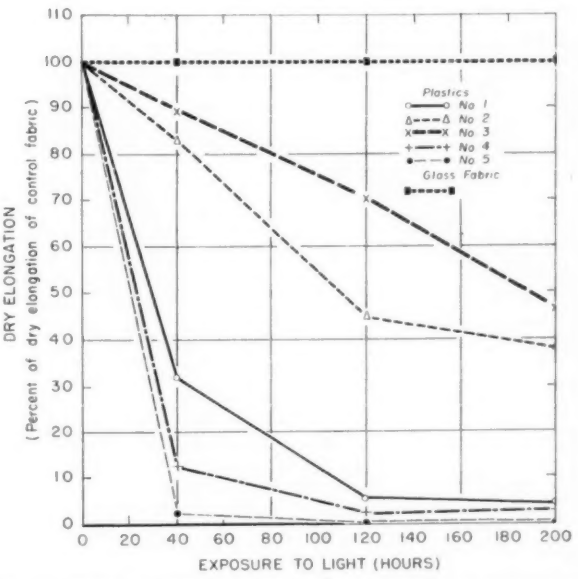

Fig. 8—Effect of exposure to light on dry elongation of plastics and glass fabric.

placing them in a drying oven at 125° C. for 25, 50, 100, 150 and 200 hours. They were exposed to light by placing them in a Fade-Ometer for 40, 120, and 200 hours.

Specimens exposed to heat and light were used dry in making breaking strength and elongation determinations of the glass fabric and plastics. Both dry and wet strips were used in making strength and elongation determinations of the other fabrics.

Light reflectance of all fabrics except plastics was measured before and after exposure to heat and light. A photoelectric reflection meter was used for these measurements.

Results of the Experiments

The 3 fabrics within each of the 7 fiber groups reacted somewhat differently in their loss in breaking strength upon exposure to heat and light. This variability was expected since the fabrics had been subjected to different finishing processes. For example, when the bleaching process of the cottons or linens was somewhat severe, deterioration upon exposure to heat and light was probably more rapid than in the cottons or linens given a milder bleach.

TABLE I. Description of fabrics and comparison of their physical properties before and after exposure to heat and light.

Fabric		Control Fabric[1] Width	Weave	Type of Yarn: Warp	Type of Yarn: Filling	Yarns per inch: Warp	Yarns per inch: Filling	Weight per square yard	Warpwise breaking strength: Dry	Warpwise breaking strength: Wet	Warpwise elongation: Dry	Warpwise elongation: Wet	Exposed Fabric: Warpwise breaking strength[2]: Heat 200 hours: Dry	Heat 200 hours: Wet	Light 200 hours: Dry	Light 200 hours: Wet	Exposed Fabric: Warpwise elongation[3]: Heat 200 hours: Dry	Heat 200 hours: Wet	Light 200 hours: Dry	Light 200 hours: Wet	Change of reflectance: Heat 200 hours	Light 200 hours
		Inches				Number	Number	Ounces	Pounds	Pounds	Percent	Percent	Percent	Percent	Percent	Percent	Percent	Percent	Percent	Percent	Percent	Percent
Cotton	1	39½	leno	single ply	single ply	50	28	1.2	25.27	26.30	8.0	9.0	83.6	79.5	88.9	87.4	83.8	92.2	100.0	122.2	—13.9	—3.5
	2	35⅛	plain	2-ply	2-ply	26	26	3.2	37.23	39.05	20.3	17.3	72.1	53.1	81.2	64.0	82.3	90.8	88.7	115.6	—18.7	—8.8
	3	59⅜	plain	2-ply	2-ply	26	28	6.2	57.24	73.45	19.7	17.7	66.4	57.4	86.6	65.4	77.7	100.0	82.7	109.0	—14.5	+4.7
Linen	1	36¼	plain	single ply	single ply	21	21	1.6	16.10	15.64	3.7	3.3	71.9	62.9	94.5	99.0	78.4	81.8	83.8	112.1	—32.6	—8.2
	2	36	plain	single ply	single ply	66	63	2.6	56.10	64.06	5.7	5.3	65.9	54.7	90.4	71.5	75.4	75.5	82.5	100.0	—21.0	—9.0
	3	36	plain	single ply	single ply	44	43	5.7	89.50	124.20	9.5	9.3	58.8	41.2	59.9	41.1	78.7	110.8	68.2	93.6	—30.4	—8.0
Silk	1	26⅜	plain	filament single ply	filament single ply	126	125	1.2	44.99	33.80	18.3	27.0	76.3	54.2	7.2	7.7	60.1	39.6	14.8	12.2	—10.1	—11.3
	2	36¼	plain	filament single ply	filament single ply	120	97	1.4	49.17	37.10	27.0	36.7	77.1	54.5	2.4	6.3	70.4	54.5	24.8	15.5	—9.9	—9.3
	3	40⅛	plain	filament single ply	filament single ply	160	100	1.8	50.00	26.75	33.7	28.0	61.6	55.8	2.7	10.5	95.0	67.9	28.8	32.1	—14.3	—6.0
Wool	1	36⅛	plain	single ply	single ply	63	56	2.8	25.83	17.23	36.0	57.7	88.6	73.0	66.0	44.7	75.0	91.8	29.7	97.0	—19.7	—10.2
	2	56⅜	2 / 1 / 2 twill	single ply	single ply	53	46	6.0	28.30	19.38	35.3	57.0	91.0	68.1	57.0	37.9	96.3	95.3	41.6	78.4	—23.2	—10.8
	3	57¼	basket variation	single ply	single ply	41	37	8.8	52.28	40.79	32.7	64.0	91.2	59.6	75.0	51.7	95.7	87.0	55.0	85.5	—18.1	—7.4
Acetate rayon	1	38⅞	plain	filament single ply	filament single ply	82	81	1.6	15.64	8.62	26.7	37.7	103.1	87.9	99.4	81.4	87.3	85.7	93.6	89.4	0	+1.5
	2	42	plain	filament single ply	filament single ply	203	64	2.8	40.73	22.66	21.3	32.0	102.5	92.5	92.3	74.4	97.2	96.9	79.8	75.9	—2.3	+ .5
	3	51¼	plain	filament single ply	filament single ply	121	55	4.9	43.49	23.06	29.3	46.3	107.2	86.6	83.8	60.2	101.4	87.0	75.1	54.6	— .8	+9.7
Viscose rayon	1	45⅛	leno	filament single ply	filament single ply	46	24	1.4	19.96	8.00	19.3	21.0	85.1	58.2	87.6	65.8	96.9	85.7	89.6	84.3	—31.7	—2.2
	2	48	plain	filament single ply	filament single ply	54	50	2.0	34.97	18.03	21.0	25.3	87.1	71.3	85.3	74.4	100.0	80.2	89.0	87.0	—29.1	—6.6
	3	39½	basket variation	filament single ply	filament single ply	97	82	2.8	38.80	16.49	20.7	19.7	79.8	52.0	47.5	29.4	77.3	62.4	42.0	47.2	—28.5	—3.8
Nylon	1	41⅜	leno	filament single ply	filament single ply	48	36	.8	44.01	31.14	28.0	21.3	44.7	45.1	2.9	2.2	58.2	65.7	13.2	12.7	—14.5	—3.4
	2	38¼	leno	filament single ply	filament single ply	56	44	1.0	46.44	36.87	29.0	26.0	65.0	53.0	40.5	30.6	81.7	69.2	64.5	56.4	—13.2	0
	3	38⅞	plain	filament single ply	filament single ply	108	85	1.9	97.22	81.50	24.7	27.3	61.8	46.8	32.2	26.9	74.8	61.2	55.5	47.6	—20.0	—6.4
Plastics	1	37	leno coated fabric	filament single ply viscose	filament single ply viscose	60	28	4.0	30.02	—	15.3	—	35.2	—	17.7	—	8.5	—	4.6	—	—	—
	2	—	plain	single ply cotton	single ply cotton	87	88	4.0	35.49	—	6.0	—	18.8	—	38.0	—	10.0	—	38.3	—	—	—
	3	36½	plain	single ply cotton	single ply cotton	72	66	4.6	38.99	—	6.7	—	40.2	—	70.8	—	11.9	—	46.3	—	—	—
	4	—	plastic film	—	—	—	—	4.0	8.33	—	153.5	—	218.8	•	5.6	—	5.4	—	3.3	—	—	—
	5	36½	plastic film	—	—	—	—	2.8	7.26	—	315.3	—	223.1	—	0	—	1.3	—	0	—	—	—
Glass fabric	1	38½	basket and plain	filament single ply	filament single ply	60	62	2.4	40.36	—	3.3	—	105.6	—	114.7	—	100.0	—	100.0	—	—6.0	—2.0

EFFECT OF HEAT AND LIGHT ON THE STRENGTH OF TEXTILE FABRICS

the 200 hours of exposure to heat and light. Cotton fabrics showed the greatest loss in strength after exposure to heat for 200 hours, while glass fabrics showed the least loss. Silk fabrics showed the greatest loss in strength after exposure to light for 200 hours, while glass fabrics showed the least loss. Among the fabrics of the other textile materials, the strength of the linen fabrics was affected the most by exposure to heat and light, while the strength of the viscose rayon fabrics was affected the least by exposure to heat and light. Among the fabrics of the other textile materials, the strength of the nylon fabrics was affected the most by exposure to heat, while the strength of the acetate rayon fabrics was affected the most by exposure to light. The strength of the plastics fabrics was affected the least by exposure to heat and light.

The change in reflectance of the fabrics on exposure to heat and light for 200 hours is shown in Figure 1. Cotton fabrics showed the greatest change in reflectance after exposure to heat for 200 hours, while glass fabrics showed the least change. Among the fabrics of the other textile materials, the reflectance of the linen fabrics was affected the most by exposure to heat and light, while the reflectance of the viscose rayon fabrics was affected the least by exposure to heat and light. Among the fabrics of the other textile materials, the reflectance of the nylon fabrics was affected the most by exposure to heat, while the reflectance of the acetate rayon fabrics was affected the most by exposure to light. The reflectance of the plastics fabrics was affected the least by exposure to heat and light.

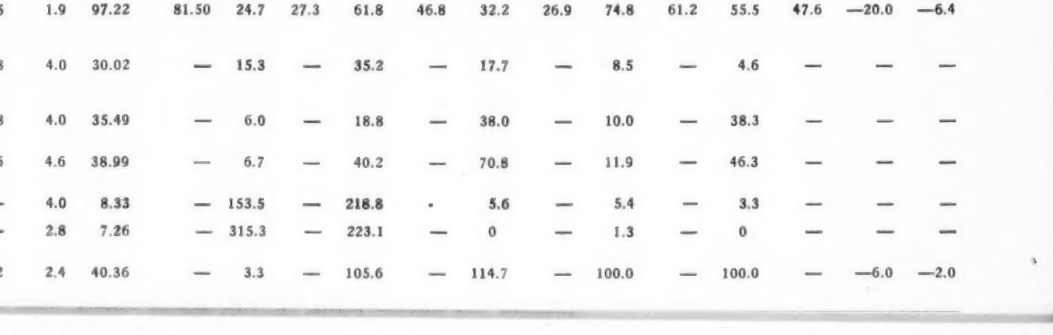

Figure 1. Change in reflectance of fabrics on exposure to heat and light for 200 hours.

EFFECT OF HEAT AND LIGHT ON THE STRENGTH OF TEXTILE FABRICS

strength after exposure to heat for 200 hours, while glass fabrics showed the least loss in strength after exposure to light for 200 hours, while glass fabrics showed the least loss. Among the fabrics of the other textile materials, the strength of the linen fabrics was affected the most by exposure to heat and light, while the strength of the viscose rayon fabrics was affected the least by exposure to heat and light. Among the fabrics of the other textile materials, the strength of the nylon fabrics was affected the most by exposure to heat, while the strength of the acetate rayon fabrics was affected the most by exposure to light. The strength of the plastics fabrics was affected the least by exposure to heat and light.

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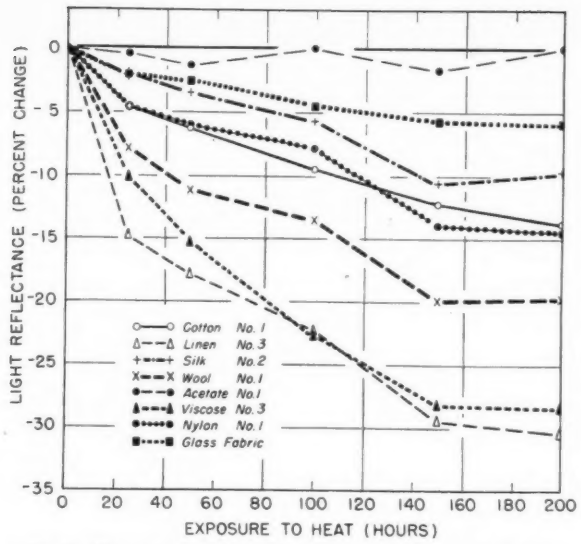

Fig. 9—Change in percent reflectance of fabrics exposed to heat.

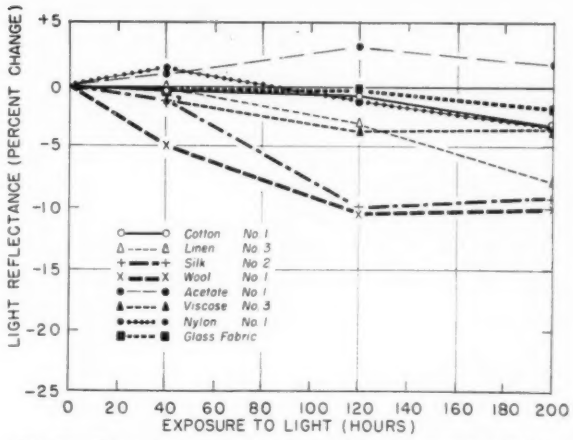

Fig. 10—Change in percent reflectance of fabrics exposed to light.

EFFECT OF HEAT ON BREAKING STRENGTH AND ELONGATION.—Of the 21 fabrics of the 7 fiber groups tested for both dry and wet breaking strength, the 3 acetate rayon fabrics changed the least in strength upon exposure to heat. Among the remaining fabrics, wool materials were most resistant to heat; linen and nylon materials least resistant. Figure 1 shows the effect of heat on the wet breaking strength of one fabric of each of the 7 fiber groups.

The elongation of most of these fabrics changed with the various treatments. The change was more pronounced in wet fabrics than in dry. Elongation of the materials usually decreased upon exposure to heat. The silk and nylon decreased more in this respect than the other woven fabrics. Figure 2 shows the effect of heat on the wet elongation of 7 fabrics.

Figures 3 and 4 show the change in dry breaking strength and elongation of the plastics and the glass fabric upon exposure to heat. The 3 plastic materials with woven backgrounds decreased considerably more in both properties than any of the fabrics of the 7 fiber groups. The 2 plastic films darkened in color and became brittle and stiff. They had nearly zero elongation when broken, but they had increased more than 200 per cent in strength after being exposed to heat for 200 hours. The heat treatment increased the strength of the glass fabric somewhat but had no effect on the elongation.

EFFECT OF LIGHT ON BREAKING STRENGTH AND ELONGATION.—The strength of all the fabrics decreased upon exposure to light. Table I shows the variation of the fabrics in each of the fiber groups. Silk and nylon were weakened most by light; wool ranked next in deterioration. Cotton and acetate fabrics were equally resistant to light; both were being more resistant to light than the other woven materials. Figures 5 and 6 show the effect of light on wet breaking strength and elongation in one fabric of each fiber group. When wet, only the three cottons and one linen increased in elongation after exposure to light for 200 hours. The silk and nylon decreased most in elongation.

Light decreased the strength and elongation of the plastics, especially of plastic films, but did not significantly affect the glass fabric. Figures 7 and 8 show the effect of light on the dry breaking strength and elongation of these materials.

EFFECT OF HEAT AND LIGHT ON REFLECTANCE.—Figures 9 and 10 show the effect of exposure to heat and light on the light reflectance of the glass fabric and on one fabric of each of the 7 fiber groups. In general, fabrics of the same fiber content followed a somewhat definite pattern.

Exposure to heat changed the color of the undyed materials, and usually gave them a yellow tone which decreased light reflectance. The decrease in reflectance was greatest in the linen and viscose rayon fabrics and least in acetate fabrics.

Exposure to light produced smaller changes in light reflectance than did exposure to heat. Decreases in light reflectance were small and were greatest for wool and silk. An increase in light reflectance was observed in the three acetate fabrics and one cotton fabric; the cotton and one of the acetate fabrics, though undyed, were creamy in color and the light bleached them.

Conclusions

Results of these laboratory experiments provide some information as to which of these 27 materials would be most durable as glass curtains or draperies. Where curtains or draperies would be subjected to heat or light such as those hanging over heat radiators and registers or at windows getting direct sunlight, fabrics made of acetate rayon or glass fiber would probably deteriorate least rapidly; those made of linen and nylon the most. Plastic film curtains might become stronger when exposed to heat but they would be unsatisfactory because they would probably become very stiff. Curtains and draperies that would be subjected to a great deal of sunlight would probably be least durable if made of silk, nylon, or plastics.

Because the glass fabric and acetate fabrics were most resistant to both heat and light, fabrics made of any of these fibers would probably prove most durable for curtains and draperies. Nylon or silk, the materials least resistant to heat and light, and plastics would be the least durable for curtains and draperies. Where it is desired that curtains retain their whiteness, the glass fabric or the acetate fabrics would be most satisfactory.

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THE ACTION OF LIGHT ON CELLULOSE ACETATE RAYON AND NYLON DYED WITH DURANOL, DISPERSOL, S.R.A., AND SOLACET DYES*

G. S. EGERTON

Abstract

A study has been made of the photochemical degradation of cellulose acetate rayon and nylon yarns dyed with dispersed and soluble acetate dyes. Measurements were made of the losses in tensile strength of the yarns after exposure to sunlight in atmospheres of dry and moisture-saturated air. Many of the acetate dyes increase the degradation of nylon to a considerable extent, but have a very much smaller effect on the degradation of cellulose acetate rayon. In several cases the loss in strength of the dyed cellulose acetate is less than that of the undyed yarn exposed under identical conditions. The photochemical degradation of both textile materials, whether dyed or undyed, is found to be due to oxidation processes.

The acetate dyes that are particularly effective in increasing the degradation of nylon are capable of increasing the degradation of undyed cotton that is simultaneously irradiated in their vicinity. In these cases the dye may be present on nylon, on cellulose acetate rayon, or as a dye film on glass. A much smaller effect is observed when undyed cellulose acetate or nylon is irradiated in proximity to these acetate dyes. Cellulose acetate rayon delustered with titanium dioxide also increases the degradation of undyed cotton irradiated in its vicinity.

The small influence of acetate dyes on the photochemical degradation of cellulose acetate rayon and their larger effect on that of nylon are interpreted in terms of a theory involving oxidation of the textile material by activated oxygen and hydrogen peroxide.

The relation between the fading of the dyed yarns and the degradation of the textile substrate is discussed, and it is pointed out that many of the dyes that increase the photochemical degradation of nylon are least fast to light on this fiber.

Introduction

At the present time the most important dyes available for the coloration of cellulose acetate rayon are the dispersed dyes, available commercially as the Duranol (ICI), Dispersol (ICI), and S.R.A. (Br. C.) brands. These dyes are mainly aminoanthraquinone derivatives, basic azo compounds, and nitroarylamines, which can be brought into a finely divided condition by grinding with dispersing agents such as Turkey Red Oil. Although these dyes are insoluble in water, they have a marked affinity for cellulose acetate. Another class of dyes for this textile fiber, known as the Solacet (ICI) dyes, consists of water-soluble compounds, which are applied to cellulose acetate in a manner very similar to that used in the application of the direct cotton dyes to cellulose. All these dispersed and soluble acetate dyes are very suitable for dyeing nylon, the former being particularly useful because of their properties of easy levelling, covering of yarn irregularities, and reproducibility of results.

Little attention has hitherto been paid to the effect of light on cellulose acetate rayon, in either the dyed or undyed state, but few, if any, complaints appear to have been received by manufacturers regarding the tendering of such textile materials on exposure to light. In the present paper an attempt is made to study the photochemical degradation of cellulose acetate and nylon yarns dyed with dispersed and soluble acetate dyes. The effect of some 64 dyes was examined, these comprising 20 Duranol, 16 Dispersol, 16 S.R.A., and 12 Solacet brands. The textile yarns were exposed to light behind glass under conditions which were described in a previous paper *(1)*, and measurements were made of the loss in strength of the yarns after exposure in atmospheres at controlled relative humidities.

It will be clear from the results to be described that while many of the dyes tested increase the loss in strength of the nylon, in some cases to a considerable extent, they have a very much smaller effect on the degradation of cellulose acetate rayon. In many cases the loss in strength of the dyed cellulose acetate rayon is less than that of the undyed yarn. It should, however, be noted that the cellulose acetate yarn was much coarser (600 denier) than the nylon yarn (180 denier). It seems unlikely that the thickness of the yarn will affect the conclusions reached, since the effect of the dye is obtained by direct comparison with the undyed yarn of the same construction.

The photochemical degradation of both nylon and cellulose acetate rayon, in either the dyed or undyed state, appears to be due to a process of oxidation, since the degradation is negligible in the absence of oxygen in the surrounding atmosphere. There is, nevertheless, a very large difference between the photochemical activity of dyes on nylon and on cellulose acetate rayon, with respect to the rate at which they sensitize the degradation of the textile material. A clear understanding of the reason for this difference is, of course, of very considerable technical importance. At least two explanations of the different behavior of dyes on cellulose acetate and nylon can be visualized. The first would assume some mechanism by which the dye became deactivated on the cellulose acetate substrate, and the second that this textile material had a marked resistance to the processes of oxidation involved. In the event of the latter explanation being correct, the dye would, strictly speaking, be photochemically active, even though it did not result in an appreciable attack of the textile material.

The experimental technique used in previous work *(2)* to study the effect of light on undyed cotton in proximity to cotton dyed with vat dyes appeared to offer one way of studying this problem. In these experiments it was found that undyed cotton yarn was considerably more degraded when exposed to light in proximity to, although not in actual contact with, an active vat dye, provided that moisture was present in the surrounding atmosphere of air. It appeared that this was due to the production of hydrogen peroxide vapor (by the vat dye), which enhanced the degradation of the undyed cotton yarn.

Similar experiments were made in which undyed yarns of cellulose acetate rayon, nylon, and cotton were exposed to sunlight in proximity to various acetate dyes. In the technique adopted the dye was present either on the supporting yarn (cellulose acetate or nylon) or as a dye film on glass. The dyes used were those which were found to accelerate the photochemical degradation of nylon. It was found that a volatile oxidizing agent, presumably hydrogen peroxide, was produced by the acetate dye and that this could cause

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increased tendering of an undyed yarn in the vicinity of the dye. This production of hydrogen peroxide occurred whether the dye was present on the textile substrate or as a dye film on glass. The increased attack of the nearby undyed nylon and cellulose acetate yarns was, however, slight and very much less than that of undyed cotton under otherwise identical conditions. This was presumably due to the resistance of the two former textile materials to oxidation by the volatile hydrogen peroxide. Indeed, in one series of experiments in which undyed cotton was exposed in proximity to dyeings on cellulose acetate rayon, it was found that in nearly every case the loss in strength of the undyed cotton was greater than that of the dyed rayon itself.

The same active acetate dye, e.g. Duranol Red G, seemed to produce hydrogen peroxide on both nylon and cellulose acetate rayon in amounts of roughly the same order, when allowances were made for the different surface areas, concentrations of dye, etc. The different effect of the acetate dyes on the photochemical degradation of nylon and cellulose acetate rayon cannot therefore be explained as due to the dye becoming deactivated in some way on the latter textile material.

It was suggested in a previous paper *(2)* that the mechanism by which vat dyes and white pigments, such as zinc oxide and titanium dioxide, sensitize the photochemical oxidation of cotton can be visualized as due to two processes of oxidation, which may occur separately or concurrently according to the particular experimental conditions. In the first process *(a)* the dye (or sensitized) absorbs the light energy and transfers this energy to the oxygen of the air, the oxygen thus becoming activated. In the second process *(b)* the activated oxygen reacts with water vapor to form hydrogen peroxide. The photochemical degradation of the cotton then involves oxidation of the cellulose by activated oxygen and/or hydrogen peroxide. It was shown that the direct oxidation by process *(a)*, involving activated oxygen, required fairly intimate contact between the dye and the textile material, whereas the indirect oxidation process *(b)*, by hydrogen peroxide, could occur when the dye and textile material were separated by appreciable distances. With cellulose acetate and nylon the amount of degradation due to the indirect oxidation is lessened by the fact that these textiles are more resistant to the hydrogen peroxide vapor than is cotton. On the other hand, nylon appears to be more susceptible to oxidation by the first process, involving activated oxygen. It was shown in a previous paper *(3)* that nylon dyed with several vat dyes, such as Caledon Gold Orange G *(Color Index,* No. 1096) and Durindone Pink FB (ICI), suffers considerable loss in strength on exposure to light in dry air, and that this degradation is not greatly increased by water vapor. The results described in the present paper similarly show that many of the dyeings of nylon made with acetate dyes suffer considerable degradation in dry air. This general phenomenon of marked degradation in dry air accompanied by the small effect of humidity on the rate of degradation must be taken as an indication of the susceptibility of nylon to attack by activated oxygen. In the light of this the resistance of nylon to oxidation by hydrogen peroxide is all the more striking.

The loss in strength of cellulose acetate rayon when exposed to sunlight in dry air is small and is not significantly increased by the presence of an acetate dye. Cellulose acetate is, presumably, not degraded by the mechanism involving activated oxygen to any appreciable extent. This may, however, be due not so much to the resistance of the textile to the activated oxygen, as to the fact that the dye is not in such intimate contact with the fiber as it is with nylon. Experimental evidence on this point is lacking, but titanium dioxide seems to produce appreciable degradation of cellulose acetate rayon (in dry air) by this mechanism of direct oxidation. In this case the titanium dioxide is intimately incorporated into the textile material during manufacture.

The results of experiments in which undyed cotton was irradiated over films of acetate dyes and vat dyes, such as Cibanone Yellow R, showed that both classes of dyes possess photosensitizing powers of roughly the same order, depending, of course, upon the particular dyes considered. The fact that the photosensitizing properties of the acetate dyes have not hitherto received much attention is due largely to their small effect upon the textile substrate (cellulose acetate) upon which they have previously been mainly used. It is clear that their effect upon the degradation of nylon is likely to be much more important technically.

A study *(3)* of the photochemical degradation of viscose rayon, nylon, and cotton in the presence of vat dyes showed that many of these dyes had a greater sensitizing effect upon the degradation of nylon than upon that of cotton and viscose rayon. In a somewhat similar manner the results described in the present paper demonstrate the greater effect of the acetate dyes upon the degradation of nylon as compared with their effect upon that of cellulose acetate. This observation, that on nylon a dye exhibits to a marked extent its photosensitizing properties, appears to be closley related to the fact that most dyes have a lower light-fastness on nylon than they have on other textile materials. It is known, for instance, that acetate and basic dyes are generally less fast to light on nylon than on cellulose acetate rayon, and that vat dyes are faster to light on cotton than on nylon. Most attention has been focussed in the past on the photosensitizing properties of the dye, but the results obtained with cellulose acetate suggests that the nature of the textile substrate may sometimes be of greater importance. There also appears to be some correlation between the light-fastness of dyed nylon and the effect of the dye on the photochemical degradation of the textile material. Many of the more fugitive acetate dyes on nylon, such as Duranol Brilliant Yellow 6G and Dispersol Yellow CY, increase the degradation of nylon considerably. Conversely, the faster dyes, such as Solacet Fast Yellow G, decrease the degradation of the nylon. Under standard experimental conditions the light-fastness of a dye depends upon two factors—(i) the constitution of the dye, and hence the resistance of the dye to oxidation by activated oxygen and hydrogen peroxide; and (ii) the photosensitizing power of the dye, i.e. its ability to produce activated oxygen and hydrogen peroxide. For a given textile material under the same conditions, the photochemical degradation depends only upon the second factor. It is clear, therefore, that perfect correlation between the light-fastness of a dye and its effect on the photochemical degradation of a textile fiber cannot be expected. The general tendency will, however, be for those dyes that are photochemically active, e.g. in sensitizing the degradation of textile fibers, to be of reduced light-fastness.

It has been reported that when combination dyeings on cellulose acetate rayon made with mixtures of the active acetate dyes, Duranol Brilliant Yellow 6G and Duranol Orange G, and blue acetate dyes are exposed to light there is abnormally rapid fading of the blue dye *(4, 5)*. This phenomenon is very similar to the abnormal fading in light of dyeings produced with mixtures of blue direct or vat dyes with active yellow or orange vat dyes *(4, 6-10)*. It would appear that both these phenomena are due to the same cause, i.e. oxidation by the volatile hydrogen peroxide produced photochemically by the yellow or orange dye.

The exact chemical constitution of many of the acetate dyes is unknown, but even in those cases where the constitution is known, the photochemical activity of the dye does not seem to depend upon a specific chemical group. The active dye Duranol Brilliant Yellow 6G (ICI) is 3-methoxybenzanthrone and has a constitution somewhat akin to the anthraquinone nucleus that is present in many of the active vat dyes. Unlike the latter, however, this dye cannot be reduced to a leuco compound with alkaline hydrosulfite. Dispersol Fast Yellow 2G is a nitroacridone, and Dispersol Yellow CY probably a hydroxyanthraquinone. The constitutions of some of the other acetate-rayon

dyes are as follows *(11, 12)*—

Duranol Red X3B — 1:4-Diamino-2-methoxy-anthraquinone.

Duranol Blue CB—1:4:5:8-Tetraminoanthraquinone.

Duranol Brilliant Blue B—1:4-Dimethylaminoanthraquinone.

Duranol Brilliant Blue G—Dimethylaminoanthrarufin.

S.R.A. Golden Yellow VIII—2:4-Dinitro-4′-hydroxydiphenylamine.

Dispersol Yellow 3G—Diazotized aniline coupled with 2:4-dihydroxyquinoline.

Of the three anthraquinone derivatives, only one (Duranol Blue CB) is active on nylon, and this only to a slight extent. The other dyes of known constitution are either inactive or protective.

EXPERIMENTAL

Materials and General Methods

The yarns consisted of *(a)* cellulose acetate rayon yarn prepared by twisting together four threads of Courtaulds' 150-denier yarn, scoured with soap and ammonia—the dull yarn (Opaceta) contained 3.3% of titanium dioxide and was nominally of the same specification as the bright (Seraceta); *(b)* nylon yarn prepared by twisting together four threads of 45-denier 13-filament American nylon, scoured with soap and ammonia—the dull yarn contained 0.33% of titanium dioxide and was nominally of the same specification as the bright. These yarns were specially made by folding yarns of commercial preparation in order to obtain coarser products that were easier to manipulate, and of relatively high breaking load. In some experiments (Tables VIII-XV) undyed cotton was used; this was 3/90s hosiery yarn of combed Egyptian cotton, scoured with caustic soda and bleached.

The cellulose acetate and nylon yarns were dyed with the insoluble Duranol, Dispersol, and S.R.A. dyes from an aqueous suspension of these dyes in the presence of Turkey Red Oil. The Solacet dyes were applied from their aqueous solutions, with the addition of sodium sulfate for dyeings on cellulose acetate rayon. Dyeings were made on the latter at 60-80°C., and on nylon at 80-90°C. Apart from rinsing, the dyed yarns were not treated further.

The technique employed in exposing the yarns to sunlight or to the light from the high-pressure mercury-vapor lamp, in atmospheres of different composition and relative humidity, and that employed in measuring the degradation of the textile yarns, have been described in previous papers *(1-3)*.

Exposure of Undyed Cellulose Acetate Rayon

The percentage strength losses suffered by cellulose acetate rayon yarns when exposed to sunlight in air at 0% and 100% R.H. are given in Table I. Results are presented for yarn free from delustrant ("bright") and delustered with titanium dioxide ("dull"). It is seen that the degradation of the cellulose acetate is increased considerably by the titanium dioxide, in both dry and moisture-saturated air. The effect of water vapor on the photochemical degradation is greater with the dull than with the bright yarn, and is particularly marked with the dull rayon after the shorter exposure.

TABLE I

Loss in Tensile Strength of Cellulose Acetate Rayon exposed to Sunlight (%)

Period of exposure	7 weeks (Sept.-Oct.)		4 months (June-Sept.)	
	0% R.H.	100% R.H.	0% R.H.	100% R.H.
Bright yarn	1	8	14	21
Dull yarn	4	43	47	88

Exposure of Dyed Cellulose Acetate Rayon and Nylon Yarns

The losses in tensile strength of cellulose acetate rayon and nylon yarns dyed with Duranol, Dispersol, S.R.A., and Solacet dyes, and exposed to sunlight in dry and moisture-saturated air for four months, are recorded in Tables II-V. All the dyeings on cellulose acetate rayon were made on the bright yarn and all the nylon dyeings on the dull yarn, delustered with a small amount of titanium dioxide.

The only one of these dyes which markedly accelerates the photochemical degradation of cellulose acetate rayon in humid air is Duranol Brilliant Yellow 6G, but small accelerating effects are shown by Duranol Light Yellow and Duranol Brown G. The effect of humidity on the degradation of these three dyeings is very marked. Under similar conditions the other dyes are more or less inactive and in many cases protective on this textile fiber. In dry air, on the other hand, none of the dyes tested increases the degradation of cellulose acetate, and the loss in strength of the dyeings is very small.

Many of the corresponding dyeings on nylon suffer considerable degradation when they are exposed to either dry or humid air. The dyes that are markedly active on nylon include two yellow, two orange, one scarlet, one red, and two brown dyes. The inactive dyes are mainly red, violet, and blue, so that there is a deficiency in suitable yellow and orange Duranol dyes. In general the effect of humidity is to increase the loss in strength of the dyed nylon, but usually to only a small extent.

The only dye that increases the degradation of cellulose acetate is Dispersol Yellow CY, but even this dye is effective only in humid air, and to a relatively small extent. With the other dyes the loss in strength is generally less in dry air than in moisture-saturated air, and less in both atmospheres than that of the undyed cellulose acetate exposed under the same conditions.

Dispersol Yellow CY and Dispersol Fast Yellow 2G increase the degradation of nylon considerably, but whereas the effect of humidity on the loss in strength of the nylon is small with the former dye, moisture has a considerable effect on that of nylon dyed with the latter dye. Most of the other Dispersol dyes are generally inactive or protective on nylon, but Dispersol Fast Orange A increases the degradation somewhat.

Only S.R.A. Orange II and S.R.A. Red VI produce as much degradation on cellulose acetate in humid air as occurs with the undyed yarn. All the other dyes, in both dry and moisture-saturated air, produce less degradation than occurs under similar conditions with the undyed yarn.

The photochemical degradation of nylon is markedly accelerated by S.R.A. Fast Golden Yellow X, Red V, Red VI, and Orange

(a) DURANOL DYES

TABLE II

Loss in Tensile Strength of Duranol-dyed Yarns exposed to Sunlight for 4 Months (June-Sept.) (%)

Duranol	Cellulose Acetate		Nylon	
	0% R.H.	100% R.H.	0% R.H.	100% R.H.
Undyed	14	21	32	30
Light Yellow	7	29	58	79
Brilliant Yellow 6G	11	45	59	79
Orange C	8	18	65	77
Orange G	16	22	63	74
Scarlet B	10	21	51	56
Red 2B	4	9	30	29
Red X3B	1	5	24	15
Red G	7	21	57	65
Brown B	2	3	19	11
Brown G	13	31	58	67
Brown R	9	24	54	63
Green B	8	10	24	49
Brilliant Blue B	5	5	22	19
Brilliant Blue G	15	17	29	25
Blue CB	8	11	42	44
Violet R	7	10	52	40
Violet 2R	0	4	19	12
Brilliant Violet B	6	5	21	17
Grey B	9	14	33	38
Black BN	11	14	26	12

(b) DISPERSOL DYES

TABLE III

Loss in Tensile Strength of Dispersol-dyed Yarns exposed to Sunlight for 4 Months (June-Sept.) (%)

Dispersol	Cellulose Acetate		Nylon	
	0% R.H.	100% R.H.	0% R.H.	100% R.H.
Undyed	14	21	32	30
Yellow CY	14	33	66	85
Yellow 3G	2	7	22	34
Fast Yellow A	0	4	14	8
Fast Yellow 2G	8	6	30	69
Fast Yellow R	4	3	14	12
Fast Orange A	1	15	47	38
Fast Orange B	0	1	16	10
Fast Orange G	3	8	22	16
Fast Scarlet B	2	7	34	23
Fast Crimson B	6	2	35	18
Fast Crimson 2B	1	5	27	15
Fast Red A	4	11	18	22
Fast Red AN	1	2	28	14
Fast Red R	4	8	19	12
Fast Brown 4R	0	2	17	21
Navy Blue R	0	4	15	35

(c) S.R.A. DYES

TABLE IV

Loss in Tensile Strength of S.R.A.-dyed Yarns exposed to Sunlight for 4 Months (June-Sept.) (%)

S.R.A.	Cellulose Acetate		Nylon	
	0% R.H.	100% R.H.	0% R.H.	100% R.H.
Undyed	14	21	32	30
Golden Yellow VIII	2	3	11	8
Golden Yellow IX	1	1	12	47
Fast Golden Yellow X	6	6	24	76
Pure Yellow I	4	8	20	30
Pure Yellow II	5	7	20	28
Orange I	1	9	35	28
Orange II	4	23	57	67
Fast Golden Orange I	0	1	14	12
Fast Golden Orange III	0	6	20	42
Red III	5	10	15	22
Red V	3	10	25	51
Red VI	7	21	55	68
Fast Red VII	8	3	24	24
Fast Violet II	0	4	20	9
Fast Heliotrope I	0	1	18	10
Fast Blue III	3	5	21	10

(d) SOLACET DYES

TABLE V

Loss in Tensile Strength of Solacet-dyed Yarns exposed to Sunlight for 4 Months (June-Sept.) (%)

Solacet	Cellulose Acetate		Nylon	
	0% R.H.	100% R.H.	0% R.H.	100% R.H.
Undyed	14	21	32	30
Fast Yellow G	0	1	13	7
Fast Orange 2GK	0	3	14	3
Fast Scarlet B	1	3	24	22
Fast Crimson B	0	5	20	13
Fast Red 5BG	2	3	11	18
Fast Red 3R	0	5	20	21
Violet B	7	10	40	76
Violet R	0	5	25	49
Fast Violet 4R	2	5	37	47
Fast Green 2G	0	5	20	14
Fast Blue 2B	6	4	17	12
Navy Blue G	0	7	22	38

II. Dyeings with the two latter dyes are little affected by humidity, but the degradation of nylon dyed with the two former dyes is much greater in humid air than in dry air. A similarly large increase in degradation due to humidity is found with nylon dyed with S.R.A. Golden Yellow IX. Most of the other S.R.A. dyes are inactive or protective on nylon.

All these dyes are inactive or protective in dry or humid air when dyed on cellulose acetate rayon. The three violet dyes, Solacet Violet B, Solacet Violet R, and Solacet Fast Violet 4R, accelerate the photochemical degradation of nylon, the first dye being particularly active in this respect. In contrast to this the two yellow and orange dyes, Solacet Fast Yellow G and Solacet Fast Orange 2GK, are protective in both dry and moisture-saturated air.

Even after allowance has been made for the fact that the degradation of the undyed nylon yarn is greater than that of the undyed cellulose acetate rayon, it is clear that the photosensitizing effect of the dye is much more marked on nylon than it is on cellulose acetate. In many cases dyes which do not increase the loss in strength of the latter textile fiber have a very serious effect on the degradation of nylon. This behavior is found with dyes of all four types, but is quite marked with the Duranol dyes.

Comparison of the fading of the same dyes on bright cellulose acetate rayon and dull nylon shows that in many cases the light-fastness is somewhat lower on the latter than on the former textile material. The difference may be very marked with some dyes, e.g. Duranol Brilliant Yellow 6G. In a few cases, e.g. Solacet Fast Yellow G and Solacet Fast Orange 2GK, the light-fastness is, however, slightly greater on the nylon. These two dyes are also noteworthy because they do not increase the photochemical degradation of nylon. In the experiments already described the fading of the dyeings was usually slightly greater in humid than in dry air with both textile materials. With the least fast dyes there was substantial fading of the dyeings in dry air. After exposure to sunlight for four months the following dyes were almost or completely bleached on nylon in moisture-saturated air—

Duranol Light Yellow
Duranol Orange C
Dispersol Fast Yellow 2G
S.R.A. Fast Golden Yellow X
Solacet Violet B
Solacet Violet R
Solacet Fast Violet 4R
Duranol Brilliant Yellow 6G
Dispersol Yellow CY
Dispersol Yellow 3G

Only the last three dyes were completely bleached on cellulose acetate under the same conditions. It is significant that only one of the above dyes, Dispersol Yellow 3G, does not increase the degradation of nylon to a marked extent in humid air.

The results given in Tables II-V refer to a long exposure of four summer months. It does not follow that the effect of the dyes on the degradation of the textile yarns is relatively the same for shorter exposures. This is due to differences in the rate of degradation of different dyeings. Some results which illustrate this are given in Table VI for an exposure to sunlight for seven weeks from September to October. All the dyes quoted in this table increase the degradation of nylon to a considerable extent after a long exposure (four months), but some of these dyes are not so effective in the shorter exposure. For instance, nylon yarns dyed with Duranol Orange G and Solacet Violet B are tendered to about the same extent in humid air after the long exposure, but on a much shorter exposure under otherwise identical conditions the degradation of the Duranol Orange G dyeing is much greater.

TABLE VI

Loss in Tensile Strength of Dyed Nylon Yarns exposed to Sunlight for 7 Weeks (Sept.-Oct.) %

Dye	0% R.H.	100% R.H.
Undyed	4	4
Duranol Light Yellow	34	29
Duranol Brilliant Yellow 6G	45	42
Duranol Orange G	30	36
Dispersol Yellow CY	43	55
Dispersol Fast Yellow 2G	11	10
S.R.A. Fast Golden Yellow X	9	11
Solacet Violet B	3	2
Solacet Violet R	1	1
Solacet Fast Violet 4R	3	2

Comparison of Dyeings with Duranol and Dispersol Dyes on Bright and Dull Nylon

Some experiments were made to compare the effect of sunlight exposure on dyeings made with a selection of these acetate dyes on bright and dull nylon. The dyeings were, as far as possible, made to the same depth in each particular case and under the same experimental conditions. It was found that bright nylon dyed with Duranol Scarlet B, Duranol Red 2B, or Dispersol Yellow CY was slightly less tendered by the exposure than the corresponding dyeing on dull nylon. There was a larger difference in favor of the bright nylon with Duranol Orange C and Dispersol Fast Yellow 2G, but with Duranol Red G, Duranol Orange G, Duranol Brilliant Yellow 6G, and Dispersol Yellow 3G, the differences between the corresponding dyeings on dull and bright nylon were negligible. The effect of humidity on the photochemical degradation of the dyeings appeared to be the same for both textile materials.

The light-fastness of the dyed yarn in either dry or humid air seemed to be little influenced by the presence of the titanium dioxide pigment in the dull nylon, except with dyeings of Dispersol Yellow 3G and Dispersol Fast Yellow 2G. With these dyes the dyeings on bright nylon were rather faster to light.

Effect of Exposure in Inert Gases

An investigation was made of the effect of oxygen on the photochemical degradation of nylon dyed with twelve of the most active acetate dyes, as indicated by their effect on nylon in Tables II-IV. These comprised some eight Duranol, two Dispersol, and two S.R.A. dyes. The dyeings were exposed in atmospheres of dry oxygen, air, carbon dioxide, and nitrogen to a high-pressure mercury-vapor lamp. Some typical results for dull nylon dyed with two of these dyes are given in Table VII. The results obtained with these and all the other dyeings tested showed that the loss in strength of the yarn was greater in oxygen than in air, although substantial in the latter atmosphere, and was negligible in nitrogen or carbon dioxide. It may therefore be concluded that the photochemical degradation of nylon dyed with acetate dyes is due to some process of oxidation. The same conclusions have also been obtained with respect to the photochemical degradation of undyed nylon and of nylon dyed with vat dyes *(3)*.

In similar exposures with cellulose acetate rayon there were generally much smaller losses in strength, but the results justified the conclusion that with both dyed and undyed cellulose acetate rayon

TABLE VII

Loss in Tensile Strength of Dyed Nylon exposed to High-pressure Mercury-vapor Lamp (250 watts) for 95 hr.
(%)

Gas at 0% R.H.	*Duranol Red G*	*S.R.A. Red VI*
Oxygen	69	67
Air	47	46
Nitrogen	2	6
Carbon dioxide	1	2

the degradation was due to oxidation. The greatest loss in strength that occurred with any of the samples of cellulose acetate was suffered by the undyed yarn delustered with titanium dioxide. When this yarn was exposed to the high-pressure mercury-vapor lamp for 240 hr., the loss in strength of the yarn was 2% in humid carbon dioxide and 88% in humid air.

Irradiation of Undyed Nylon (or Cotton) in proximity to Nylon dyed with Acetate-rayon Dyes

Experiments were made in which undyed cotton or nylon was exposed to sunlight in humid air in proximity to nylon dyed with many of the acetate dyes that are most effective in increasing the photochemical degradation of nylon. In these experiments the undyed yarn was interspaced with the dyed yarn, the distance between intervening threads being of the order of 0.3 mm., and every undyed thread being flanked on each side by a dyed thread. The losses in strength of undyed yarns of cotton and nylon when they were exposed in proximity to bright and dull nylon dyed with Dispersol Yellow CY are given in Table VIII. The undyed nylon used was the same as that of the dyed yarn, e.g. bright undyed nylon was exposed in proximity to bright dyed nylon. Although the degradation of the undyed nylon is increased slightly by the proximity of the dyed nylon, the latter has a much greater effect upon the degradation of the undyed cotton. The photochemical effect of the dye is very similar whether present on the bright or dull nylon, and does not seem to be significantly influenced by the presence of the titanium dioxide pigment.

TABLE VIII

Loss in Tensile Strength of Undyed Cotton and Nylon exposed, in the presence of Nylon dyed with Dispersol Yellow CY, in Air at 100% R.H. to Sunlight for 5 Weeks (July)
(%)

	Adjacent Undyed Nylon	*Isolated Undyed Nylon*	*Adjacent Undyed Cotton*	*Isolated Undyed Cotton*
Bright nylon	12	3	33	7
Dull nylon	19	15	34	7

The effect of dull nylon dyed with other acetate dyes on the photochemical degradation of cotton is illustrated in Table IX. The results show that these dyeings also increase the degradation of adjacent undyed cotton to an appreciable extent. The cause of this phenomenon is the production of a volatile oxidizing agent by the irradiation of the acetate dye. It was found that when such dyes were irradiated in moist air in proximity to starch-iodide paper, the color change of the latter after a few hours' exposure to sunlight indicated the production of an oxidizing agent. This volatile agent would appear to be hydrogen peroxide by analogy with the results obtained with active vat dyes and zinc oxide, which were described in a previous paper *(2)*.

TABLE IX

Effect of Presence of Dyed Dull Nylon on Tendering of Undyed Cotton exposed in Air at 100% R.H. to Sunlight for 3 Months (Aug.-Oct.)

Dye	*Loss in Tensile Strength (%) Dyed Nylon*	*Undyed Cotton*	*Fluidity Rise of Undyed Cotton*
Isolated undyed cotton	—	14	11.3
Duranol Orange C..	40	26	18.5
Duranol Orange G..	54	27	—
Duranol Red G	31	28	23.2
S.R.A. Red VI	39	26	22.4

Irradiation of Undyed Cellulose Acetate (or Cotton) in proximity to Cellulose Acetate dyed with Acetate-rayon Dyes

The effect of acetate dyes, such as Duranol Orange C, on the loss in strength of cellulose acetate rayon on exposure to light is usually slight and very much less than their effect on that of nylon. It might therefore be thought that these dyes are less active on this substrate than on nylon. However, the term "active" in this connection is to be interpreted in a strict photochemical sense and not in its technical sense, the degradation of the textile substrate, in which respect these dyes are generally inactive on cellulose acetate. In order to investigate this point undyed cotton and cellulose acetate rayon yarns were exposed to sunlight in proximity to dyed cellulose acetate yarns, in the manner already described for dyed nylon. The results of one such exposure in humid air are given in Table X. It is seen that, whereas the degradation of the undyed cellulose acetate is not affected by the presence of the dyed yarn, the degradation of the undyed cotton is markedly greater in the presence of the acetate dye. It must therefore be concluded that a considerable amount of hydrogen peroxide is formed by the acetate dye on exposure to light, but that the cellulose acetate is largely resistant to oxidation by this agent.

The effect of cellulose acetate rayon, dyed with S.R.A. Red VI and other acetate dyes, on the degradation of undyed cotton exposed to light in its vicinity is compared in Table XI with the effect of these dyes on the degradation of the cellulose acetate itself. Although most of the dyes do not increase the degradation of the cellulose acetate to any marked ex-

TABLE X

Loss in Tensile Strength of Undyed Cotton and Cellulose Acetate Rayon exposed, in the presence of Cellulose Acetate Rayon dyed with S.R.A. Red VI, in Air at 100% R.H. to Sunlight for 5 weeks (July)
(%)

	Undyed Cellulose Acetate Rayon	*Undyed Cotton*
Isolated yarn	6	6
Yarn adjacent to dyed cellulose acetate	6	27

tent, it is seen that they increase the degradation of the undyed cotton very considerably. Indeed, in most cases the loss in strength of the undyed cotton is greater than that of the dyed cellulose acetate in its vicinity.

These results make it clear that dyes which do not substantially increase the degradation of the textile substrate may yet be photochemically very active. The effect of these dyes on the degradation of undyed cotton exposed to light in their vicinity is some measure of their absolute activity in a strict photochemical sense. On this basis it is possible to compare their activity with that of the orange and yellow vat dyes, which sensitize the photochemical degradation of cotton, nylon, and other textile fibers. Experiments were therefore made with *(a)* cotton dyed with the vat dye Caledon Yellow 5G (ICI), *(b)* nylon dyed with the vat dye Cibanone Orange R (*Color Index*, No. 1169), *(c)* nylon dyed with Dispersol Yellow CY, and *(d)* cellulose acetate rayon dyed with Duranol Brown R. The results, given in Table XII, show that there is substantial degradation of all the dyed yarns with the exception of the dyed cellulose acetate, the resistance to degradation of the latter being exceptionally striking. All the four dyeings have a somewhat similar effect on the degradation of the undyed cotton in proximity to the dyed yarn. It must therefore be presumed that some, at least, of the acetate dyes are photochemically of the same order of activity as the orange and yellow vat dyes.

TABLE XI

Loss in Tensile Strength of Undyed Cotton and Dyed Cellulose Acetate Rayon exposed together in Air at 100% R.H. to Sunlight for 3 Months (Aug.-Oct.)
(%)

Dye	*Dyed Cellulose Acetate Rayon*	*Undyed Cotton*
Isolated undyed cotton	—	14
Duranol Light Yellow	18	39
Duranol Brilliant Yellow 6G	26	25
Duranol Orange G	21	30
Duranol Red G	11	31
Duranol Brown G	24	31
Duranol Brown R	23	47
Dispersol Yellow CY	25	44
S.R.A. Orange II	16	28
S.R.A. Red VI	12	40

TABLE XII

Tendering of Undyed Cotton and Dyed Yarns exposed together in Air at 100% R.H. to Sunlight for 6 Weeks (May-June)
(%)

Dyed Yarn	*Loss in Tensile Strength %*		*Fluidity Rise of Adjacent Undyed Cotton*
	Dyed Yarn	*Adjacent Undyed Cotton*	
Isolated undyed cotton	—	7	7.5
Cotton dyed with Caledon Yellow 5G	74	25	23.0
Nylon dyed with Cibanone Orange R	80	31	25.2
Nylon dyed with Dispersol Yellow CY	73	39	28.1
Cellulose acetate rayon dyed with Duranol Brown R.....	9	33	24.0

Irradiation of Undyed Yarns over Films of Acetate Dyes

In these experiments the undyed yarn was exposed in a single uniform layer about 4 mm. in front of a film of dye, made by pasting the commercial dye powder with water and painting on a glass plate. After drying, the dye formed a durable film on the glass. The undyed yarn was supported on a glass frame which rested on the glass plate at portions which were free from dye, and was placed inside a glass cell, containing water, and exposed to sunlight. The light fell on the undyed threads, which were spaced about 0.7 mm. apart in order not to obstruct the passage of the light, and then on the dyed film. Using this method, comparison could be made of the effect of films of acetate and vat dyes on the photochemical degradation of undyed cotton. The results of such an experiment with two very active vat dyes and four acetate dyes are shown in Table XIII. It is seen that there is considerably increased degradation of the undyed cotton exposed over all the dye films, and it is significant that the acetate dyes are as effective in this respect as the active vat dyes.

TABLE XIV

Loss in Tensile Strength of Undyed Yarns exposed over Dye Films in Air at 100% R.H. to Sunlight for 5 Weeks (July)
(%)

Dye Film	*Undyed Bright Nylon*	*Undyed Cellulose Acetate*	*Undyed Cotton*
None	1	8	4
Duranol Orange G..	8	11	35
Duranol Red G	16	12	45

The effect of exposing undyed yarns of cellulose acetate, nylon (bright), and cotton over films of acetate dyes is illustrated in Table XIV. There is marked degradation of the cotton, but much less attack of the nylon and cellulose acetate rayon.

Irradiation of Undyed Cotton in proximity to Cellulose Acetate Rayon delustered with Titanium Dioxide

Marked loss in strength of the textile material occurs when cellulose acetate yarn delustered with titanium dioxide is exposed to sunlight in humid air. Under such conditions the dull rayon is capable of increasing the degradation of undyed cotton simultaneously exposed in its vicinity (Table XV).

TABLE XV

Effect of Presence of Dull Cellulose Acetate Yarn on Fluidity Rise of Undyed Cotton exposed in Air at 100% R.H. to Sunlight for 3 Months (Aug.-Oct.)
(%)

	Fluidity Rise	
	Isolated Yarn	*Adjacent Yarn*
Undyed cotton	11.3	19.6

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TABLE XIII

Loss in Tensile Strength of Undyed Cotton exposed over Dye Films in Air at 100% R.H. to Sunlight for 6 Weeks (May-June)
(%)

	Dye Film	
None		13
Vat Dyes	Cibanone Yellow R (Colour Index, No. 1170).....	60
	Cibanone Orange R	44
Acetate dyes	Duranol Brilliant Yellow 6G	54
	Duranol Orange G	41
	Duranol Red G	58
	Duranol Brown R	43

THE FINISHING OF NYLON FABRICS*

DR. J. E. SMITH

THE textile finishing art is probably as old as textile manufacture. It is practiced to enhance the general appearance and sales appeal of fabrics as well as to provide or impart qualities to textile fibers which they do not normally possess. Fibers and fabrics so treated become better adapted to specific purposes.

The finishing processes fall into two main classes, mechanical and chemical. Mechanical finishing treatments of nylon fabrics, such as heat setting, tentering and calendering, are essential and have an effect not only on the dimensional stability, but also on the hand of the fabric. However, it is frequently advantageous to augment the mechanical treatments by the use of textile chemical auxiliaries. For example, the scouring and cleansing of the fabric with detergents is necessary to produce a good appearance. Agents to control luster are often desirable. While draping and bodying characteristics are regulated in part by heat treatments, textile softeners and resins are commonly used to obtain further modifications toward either greater pliability or increased stiffness. Agents for reducing and eliminating the formation of static electricity are highly desirable. Nylon is relatively non-absorptive to water, but treatments to impart additional water-repellent properties to the fiber surface may be required by the end use for which the fabric is designed. Products which increase the slip resistance of the yarns are sometimes needed to prevent seam slippage and to maintain freedom from distortion within the fabric itself.

The scouring or boiling off of nylon fabrics is primarily for the purpose of removing sizes and oils previously applied to the yarn to facilitate weaving. In addition a scouring process is required to remove mill oils, greases and solid soils, such as graphite, which have accumulated on the fabric during the mill processing operations. It is usually accomplished by subjecting the fabric to the action of synthetic detergents, soaps and alkalies at temperatures usually from 180°F. to the boil in scouring equipment which imparts mild mechanical action. However, there will be instances in which certain types of grease and contaminants are more difficult to remove, particularly if the fabric is subjected to heat-setting before scouring.

In considering the scouring problem, it should be pointed out that in general textile processing, soil removal is closely related not only to the efficiency of the detergent, but also to the degree of mechanical action employed in the scouring process. The intensity of mechanical action required to remove the soil is related to the strength of the forces bonding the soil to the nylon. Heat-setting processes for nylon fabric sometimes increase the tenacity with which soil is held. The agitation required to clean the fabric will also depend upon the concentration and inherent effectiveness of the detergent in solution. The efficiency of most detergents is increased by an increase in temperature and by the addition of alkalis. A third factor influencing the degree of mechanical action is the time of scouring. Soil removal is usually commensurate with the degree of mechanical action, the detergent concentration, temperature and time of scouring.

The importance of mechanical action in cleansing nylon is shown by the fact that simple hand scrubbing in the laboratory with a detergent solution and a fine abrasive will remove the most tenaciously held soils. While it would appear on first thought that the solution of any scouring problem can be obtained by selection of a scouring machine capable of imparting sufficient mechanical action, the answer is not that simple. Very careful consideration must be given to the effect of such action on the physical properties and appearance of the fabric. The resistance of the material to creasing and wrinkling is important. Resistance to creasing depends on the degree of heat-setting of the fabric, the weight and tightness of fabric construction and the type of yarn, filament or staple, employed in manufacturing.

A consideration of the foregoing comments shows that selection of scouring conditions by the fabric finisher is closely associated with the heat-setting requirements for fabric stabilization. It is, of course, preferable to remove size and oil before any heat-setting operation. Under this condition, the fabric usually can be easily cleaned by detergent and water when scoured in open width at 180°F. A machine such as a jig which provides mild mechanical action is most satisfactory for preventing wrinkles. However, it may be that dimensional stability is such a problem that heat-setting is favored before the scour. As stated before, contaminating mill oils, greases and solid soils may become more firmly fixed and the scouring problem may be made more difficult. The ideal solution is of course, to keep the contaminants off the fabric, but if they are present, then it becomes necessary to employ more severe scouring conditions to obtain their removal.

Methods which employ a minimum of mechanical action for scouring nylon woven fabrics are:

1. *Boiling-off or scouring on a jig.* The fabric is passed from roll to roll through the bath. The method has the advantage of keeping the fabric under constant tension, flat and free of wrinkles, and is particularly desirable where scouring is carried out in advance of pre-setting. Temperatures of 180°F. to the boil can be used. Creases or wrinkles on the jig (especially at high temperatures) will undoubtedly show up as creases or dye breaks in the finished fabric.
2. *Boiling-off or scouring in a continuous boil-off machine.* The fabric is pulled through the bath over rollers in a tub approximately 50 feet long. It is kept flat but tension is not maintained as evenly as in a jig. Scouring temperatures of 120°-140°F. may be advisable in this equipment unless the fabric has been adequately heat-set prior to the scour.
3. *Boiling-off or scouring in book or skein form.* The fabric is handled on sticks and immersed in the bath in a folded or book form. There is relatively little tension. A low scouring temperature (120° to 140°F.) is advisable unless the fabric has been heat-set prior to the scour.

When more vigorous agitation is required, it is suggested that the fabric be scoured in a beck. The two ends of the material are sewn together around an oval roller which, in turning, drops the fabric into the bath in folds at one end of the tub and draws it out of the bath at the other end. Heat-setting of the goods is usually required before scouring in the beck. Otherwise wrinkles may be formed in the fabric particularly if it is heavy or tightly woven. Even greater mechanical action can be obtained in a Rodney Hunt machine or a rope soaper, but only selected fabric constructions, heat-set under the best conditions, can be scoured

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in such equipment without wrinkles or creases.

Nylon woven fabrics are normally scoured with a detergent such as a long-chain fatty alcohol sulfate, soap, or a combination of the two, and an alkali such as trisodium phosphate. A typical scouring formula is:—

2% Duponol D. Paste
2% Soap
2% Trisodium Phosphate
} Percentages based on weight of goods.

Scouring is carried out in a bath containing a 20:1 to 30:1 ratio of liquor to goods. With consideration for heat-setting conditions, a scouring period of up to one hour at a temperature of 180°F. to the boil may be used. Badly soiled fabrics may require increased concentration of detergent to suspend the soil. Hydraphtal, Merpol B or Merpol C, textile processing agents, all of which combine solvent action with detergent power, may be useful where there is heavy contamination involving greases and oils. When contamination on the fabric is particularly hard to remove, it may be helpful to impregnate the material with a hot concentrated detergent solution and allow it to stand for 3 to 4 hours in the roll before proceeding with the boil off.

Experimental work carried out during the past few months indicates that when selected surface-active agents, having detergent and antistatic properties are incorporated in the coning oil used for fiber lubrication, the ease of scouring nylon fabrics is improved. The work to date concerns lace manufacture where the fabric becomes heavily soiled with graphite during the weaving. The application of a coning oil, based on Product BCO, Spinning Lubricant L and Hexalin, facilitated the removal of soil in the regular scouring operation. It appears that the principle of using a surface-active agent, with high detergent efficiency and pronounced antistatic properties, in the coning oil may be extensively applied to problems where extreme contamination of fabrics is hard to avoid.

An important phase of textile finishing is the modification of the hand of the fabric. Physical properties which are involved and terms to be employed in describing them have been recommended on the basis of work at the National Bureau of Standards (see Table I).

Finishing compounds employed to modify the hand of materials include softening agents and bodying or stiffening agents. By the use of dry heat treatments, it is possible to vary the physical characteristics of nylon fabrics so that they are softer and have improved draping qualities. However, selected surface-active agents can have a further effect on flexibility, compressibility and surface friction to produce additional softness and draping properties. Both cationic and anionic surface-active textile finishes are used in treating nylon fabrics. It is obvious that since nylon is associated with high quality merchandise, it is to the advantage of the finisher to use textile softeners which are highly effective fabric finishes. They should also be resistant to oxidation, discoloration and odor development on exposure to air, light and heat under processing, storage and use conditions. The greater degree of fiber flexibility and pliability is usually obtained by the use of cationic agents. Selected anionic agents also improve these properties and may, in addition, impart surface lubrication and a degree of fullness (associated with apparent density).

A range of fabric softening effects can be obtained by the use of Avitex R, cationic softener, or Avitex SF, Avitex C and Avitone A, anionic softeners. The concentration and type of softener applied will vary depending on the fabric construction and detailed requirements of hand. In general, the effective concentration range is 0.5% to 2% of product on the weight of the goods. Avitex R is the most widely used at present to increase fiber flexibility and compressibility without altering the surface friction. When the use of a cationic agent is undesirable, the required finishing can be effected with Avitone A, Avitex C or Avitex SF. These three products may differ among themselves and from Avitex R in the detailed results, depending in part on the fabric construction. Avitone A imparts fiber flexibility and compressibility as well as surface lubricity and increased fullness (or an apparent increase in fabric density or body). Avitex SF and Avitex C increase fiber flexibility and compressibility, while Avitex C, in addition, provides a degree of lubrication.

Many nylon fabrics require bodying and stiffening agents to decrease fiber flexibility and compressibility where crisp effects are desired. Selected resins are frequently used for this purpose. The resin may advantageously be a fully polymerized thermoplastic type applied from an aqueous dispersion by padding. Application to the fabric is usually done at temperatures ranging up to 120°F. Higher temperatures are seldom required to obtain thorough impregnation of the fabric. Drying is carried out on a tenter at any suitable temperature. In selecting a resin it is well to bear in mind that dispersions, which are highly stable under the conditions encountered in padding, are required to avoid agglomeration in the pad bath with resultant resin spots on the goods. The resins deposited on the fabric must have sufficient hardness to develop the required crispness but must, in addition, be sufficiently tough so that the films deposited on the individual fibers are not easily broken by flexing. The resin should be transparent and colorless, or only slightly colored, so that application will not interfere with the brilliance of shade of the fabric or discolor white fabrics. They must remain colorless under the influence of light and heat normally encountered by the fabric during its useful life. The ideal resin should have sufficient cohesion for nylon in the presence of alkaline soap solutions to resist removal by laundering.

Methacrol FNH, aqueous resin dispersion, is recommended as an excellent bodying agent for producing crisp finishes on nylon fabric. The dispersion and the resin contained in it meet the requirements previously described with the exception of wash fastness. The quantity of Methacrol FNH required will vary widely depending on the degree of crispness desired and the fabric construction. The application of 1 to 5% on the weight of

TABLE I

Proposed Terms to be Used in Naming the Physical Properties of Fabrics Related to Hand and for Describing the Corresponding Components of Hand

Physical Properties	*Explanatory Phrase*	*Terms to be Used in Describing the Range of the Corresponding Components of Hand*
1. Flexibility	Ease of bending	Pliable (high) to stiff (low)
2. Compressibility	Ease of squeezing	Soft (high) to hard (low)
3. Extensibility	Ease of stretching	Stretchy (high) to non-stretchy (low)
4. Resilience	Ability to recover from deformation in which rate of recovery is without limits and thus includes elasticity (instantaneous recovery)	Springy (high) to limp (low). Resilience may be flexural, compressional, extensional, or torsional.
5. Density	Weight per unit volume (based upon ASTM standard measurement of thickness and fabric weight)	Compact (high) to open (low)
6. Surface Contour	Divergency of the surface from planeness	Rough (high) to smooth (low)
7. Surface Friction	Friction to slipping offered by the surface	Harsh (high) to slippery (low)
8. Thermal Character	Apparent difference in temperature of the fabric and the skin of the observer touching it	Cool (high) to warm (low)

fabric produces a wide range of effects.

Crisp finishes that are laundry fast on nylon are produced with urea formaldehyde and (more particularly) melamine formaldehyde types of resins. They are developed on the fabric by a thermosetting condensation which requires the use of heat and a catalyst to obtain a satisfactory cure.

A problem which frequently arises in nylon fabric finishing is the minimizing of luster. The application of white pigments from dispersed form is accompanied by chalking and an artificial appearance. Attempts to use carbon black in small quantities produces greying. The best approach known at present for minimizing luster is the use of selected resins applied as water dispersions. The effectiveness of the selected resins in scattering light is probably associated with their refractive index and application in the form of discrete particles. Products which produce a pronounced dulling on nylon are Methacrol NH and Methacrol SH which are aqueous dispersions of resins. The degree of delustering is pronounced after the application of 4 to 8% of these products (based on the weight of the fabric). The delustering is not characterized by chalkiness or opacity which dulls the brilliance of the colors on the fabric.

Methacrol NH and Methacrol SH are cationic aqueous dispersions of resins that can be applied either by padding or by a process of exhaustion from a dilute bath. The treated nylon can be dried on a frame at any desired temperature.

It is frequently desirable to improve the slip resistant properties of nylon fabrics to avoid distortion of the weave, to increase seam strength and to improve the ease of handling on cutting tables in garment manufacture. The application of 3 to 6% Methacrol NH or Methacrol SH produces a marked increase in the slip resistance of a number of nylon fabrics. The degree of improvement naturally depends in part on the fabric construction. These resin dispersions also provide body in nylon fabrics.

A major problem in handling nylon is the development of static electricity on the fabric during processing and handling. A serious static problem on nylon can exist between the final drying of the dyed and finished fabric and the first washing of the merchandise by the ultimate consumer. If a satisfactory antistatic finish is not employed, sparks may occur when the finished fabric is being inspected, to the extreme discomfort of the inspector. The presence of a static charge is a handicap to the cutter in garment manufacture. When laying out multiple layers of nylon fabric for cutting, static causes the fabric layers to wrinkle and distort, thus making it very difficult to cut accurate patterns with a minimum of waste. Because of static attraction, the fabric may pick up lint and dirt during cutting and sewing operations. This same attraction causes nylon merchandise, in the form of wearing apparel on counters or curtains hung for display, to pick up dirt more quickly with possible loss to the retail store.

Avitex R, cationic textile softening agent, applied to deposit 0.5 to 1% product on the weight of the fabric is an effective antistatic agent for nylon. Avitone A, anionic textile softening agent, is also effective when applied to deposit 1 to 2% product on the fabric. The application of these products is by an impregnation or padding operation followed by drying on a frame. The finish is not durable to laundering. Antistatic agents for nylon, that remain effective following the number of launderings likely to be encountered during consumer use, are not known at present.

Since Avitex R and Avitone A impart a combination of excellent softening and antistatic effects to nylon, these two products should prove to be particularly valuable to the finisher of nylon fabrics.

An important aspect of nylon processing is the effect of the finish on flammability. The chief factor when considering the fire hazard in connection with textile uses is whether flame propagation occurs after the igniting source is removed. The natural flammability of clean nylon is very low and considered satisfactory for textile purposes. Undyed, finish-free nylon yarn melts at a temperature of approximately 480°F. When a flame is applied to clean nylon, the fabric melts and the melted portion drops from the material. When the flame is removed there is little or no tendency to further flame propagation. If flammable oils or finishes are present on nylon, there is the possibility that combustion will be supported because of their presence. The presence of certain pigments or dyes may also increase flammability.

Avitex R, Avitex C, Avitex SF and Avitone A do not increase the flammability of nylon fabric as shown by the following tests. Applications of 1% of the products were made by a padding operation to strips of clean, undyed nylon fabric. The treated fabrics were air-dried at 250°F. Strips of fabric cut 12.5 inches warpwise by 2.5 inches fillingwise were suspended vertically from a rod. The yellow flame from a Bunsen burner, obtained by leaving off the top spreader attachment and shutting off the air at the base, was adjusted to a 1.5 inch height. The flame was applied for 12 seconds with the bottom of the fabric extending initially 0.75 inch into the flame. In all cases, the fabric melted to about 2 inches above the tip of the flame without further combustion. The test samples could not be ignited by moving the flame up until essentially all of the fabric melted away from the support.

While the nylon fiber has relatively low absorption for water compared with viscose-process rayon, cotton, and wool, it nevertheless is readily wetted by water. As a result treatments of nylon fabric with water-repellent compositions are required to obtain satisfactory consumer acceptance in the field of rainwear manufacture. A durable water-repellent finish can be obtained on nylon by the application of Zelan AP Paste. Application of approximately 3% Zelan AP Paste on the weight of the goods will, in general, produce an initial spray test rating of 100 and spray test ratings of 80 after 3 Zelan Specification laundering on dry cleaning tests for synthetic fiber fabrics. Water absorption by the standard A.A.T.C.C. Immersion Absorption Test will generally be in the range 7 to 11% of water initially and 8 to 15% water after 3 Zelan Specification rayon launderings. It should be pointed out that the Zelan Specification rayon wash test calls for laundering the fabric 40 minutes in a loaded wash wheel at 120°F. in a 0.1% neutral soap solution. The dry cleaning test calls for tumbling treated-fabric samples for 20 minutes in Stoddard solvent in jars agitated by means of a Launder-Ometer at 80°F.

The application of Zelan durable water repellent is made by padding the fabrics in a water solution containing a sodium acetate buffer. Padding is usually carried out at a temperature of 90° to 110°F. The treated fabrics are dried and cured at temperatures of 275° to 300°F. and then given a mild wash in a solution of synthetic detergent and soda ash. Final drying is carried out preferably at 275° to 300°F. to obtain the best degree of repellency.

Treatment of nylon fabric with too high a concentration of Zelan accentuates the problem of chalking inherent in certain constructions. For example, when the treated fabric is rubbed with the fingernail, white marks develop. Cold calendering of the treated fabric often materially improves this condition. However, when the calendered fabric is subsequently hot-pressed, it again tends to chalk mark but not as extensively as the non-calendered fabric. Mechanical working or manipulation of the treated fabric will also remove the chalk marks. In view of this problem, it is recommended that nylon fabrics be pre-tested for application of Zelan AP Paste durable water repellent before treating large yardages on a mill basis. In reaching a decision on this problem, it should be borne in mind that marks which are not pronounced and which are readily removed by mechanical manipulation may not be objectionable on fabrics used in garments which are subjected to considerable mechanical action during wear.

Zelan AP Paste, durable water repellent, has very little effect on the shade, strength, light fastness and crocking fastness properties of the range of acid colors used in dyeing nylon. The application of Zelan AP Paste to nylon dyed with acetate colors has a pronounced effect on the shade and strength of many of the dyes. Care must be exercised in the selection of acetate color combinations to be used on fabrics which will later be treated with a durable water repellent.

Excellent water repellency can also be obtained on nylon fabrics by treatment with wax-aluminum salt compositions such as Aridex L Conc. or Aridex WP. Application is made by padding and then drying at any suitable temperature in the range 220° to 275°F. The application of the wax-type water repellents may be accompanied by chalking of the finish as described previously. Laboratory applications should be made to nylon fabrics and the water-repellent and chalking effects noted before proceeding with large-scale processing. Wax-aluminum salt type compositions are not recommended for application to fabrics where durability of the finish to laundering and dry-cleaning is a requirement.

It should be emphasized that proper fabric construction, with consideration for the end use, is required to assure satisfactory consumer acceptance of garments made from material finished with the best possible water-repellent treatments. By the use of such testing devices as the Impact Penetration Tester and the Rain Tester (Tentative A.A.T.C.C. Test Methods), it is possible to predict whether a water-repellent treated nylon fabric is suitable for use in rainwear. While the textile finisher may feel that his primary purpose is to supply a good water-repellent treatment, in terms of spray and water immersion tests, much confusion as to what constitutes a good treatment, from the point of view of the ultimate consumer, can be avoided if the importance of satisfactory fabric construction is also stressed.

A number of nylon fabric finishing problems have been discussed in general terms in this paper. No attempt has been made to provide a detailed solution to the individual finishing problems which occur in the various plants. Each problem usually requires its own specific solution which involves a study of all the factors, including processing and handling, pertinent to the individual mills.

ABSTRACTS

Fungicide-Treated Cotton Fabric: Outdoor Exposure and Laboratory Tests

S. S. Block, Industrial and Engineering Chemistry, page 1782, Vol. 41, No. 8, August, 1949.

Results are presented of two years of outdoor shade exposure, in Florida, of cotton fabric treated with fungicidal preservatives. Untreated 10-ounce cotton duck lost 67% of its tensile strength in one year and 93% in two years. Of the different fungicides applied to the fabric in a concentration of 1% of the dry weight of the treated fabric, only the copper and silver compounds stood up well after two years in the field. With the copper group, the copper ion, rather than the anion or whole molecule, appeared to be the protecting agent. The mercurials and other heavy metal fungicides did not afford protection for the two-year period. The phenolic group were the only purely organic fungicides that rendered the fabric appreciably resistant to microbial decomposition. Water-repellent treatment improved the performance of the phenolic but not the copper fungicides. Laboratory soil burial tests were, in general, in agreement with the outdoor exposure tests.

Effect of pH When Bleaching with Hydrogen Peroxide

Canadian Textile Journal, page 46, Vol. LXVI, No. 8, April 15, 1949.

It is pointed out that hydrogen peroxide is stable to heat when free from alkaline substances, heavy metal compounds and solid bodies such as silica and bacteria. Factors affecting the stability of hydrogen peroxide bleach baths are the equipment and water, the fiber to be bleached, type of alkali to be used, pH and temperature.

Commercial hydrogen peroxide usually has a pH of 3 or less and any increase in pH value results in decomposition which becomes quite rapid at pH values above 7. Curves showing the rate of decomposition of peroxide with various chemicals are given. Chemicals affecting hydrogen peroxide decomposition are divided into two groups: (1) activators such as soda ash and caustic soda and (2) stabilizers or regulators such as sodium silicate and sodium pyrophosphate.

The Spectrophotometer as an Aid to Dyeing

Frederick T. Simon, Canadian Textile Journal, page 52, Vol. LXVI, No. 6, March 18, 1949.

The various types of commercially available spectrophotometers are briefly reviewed and typical applications of the instrument to dyeing are given.

It is common practice to evaluate dye strengths of water-soluble dyes with a spectrophotometer. These techniques have led to methods for evaluation of certain insoluble dyes such as the azoics and vat dyes.

Control of dye baths can be accomplished by comparison of successive batches to a predetermined standard. This method can be used on print pastes simply by taking an aliquot of the print paste and diluting it.

There are many complications in the matching of dyed shades with the spectrophotometer. However, excellent results were obtained on a flat worsted cloth.

Accelerated Ageing Tests to Simulate Actual Use of Fabrics

Textile Age, page 54, Vol. 13, No. 5, May, 1949.

Working under grants-in-aid from American Viscose Corporation, the Ellen H. Richards Institute of the Pennsylvania State College, has devised a number of accelerated ageing tests for use on rayon fabrics.

The accelerated tests include those for gas and light fading, heat resistance (both steam and dry), and laundering. In addition, tests for abrasion resistance and dry and wet cleaning have been standardized.

Synthetic Detergents Have Broad Application

Dr. O. M. Morgan, Textile World, page 129, Vol. 99, No. 4, April, 1949.

Synthetic detergents which were developed about twenty years ago for special applications are now commercially available on competitive basis with soap as a result of mass production methods. Syn-

thetic organic detergents offer a range of physical and chemical properties among them being stability of acids, alkalies and hard water as well as wetting, scouring and emulsifying ability.

The sodium alkyl aryl sulfonate type is an economical, efficient agent for the scouring of raw wool and, in particular, pulled wool where large quantities of lime are encountered. This type is also effective for the scouring of woolen and worsted yarns or piece goods. In addition, the sulfonated type may be used for various fulling applications.

Synthetic detergents are widely used on cotton for such processes as kier boiling, peroxide bleaching, washing prints and dyed pieces, and in the preparation of absorbent cotton. The desizing, scouring and dyeing of synthetic fibers is greatly aided by the use of detergents.

The Surface Dyeing of Plastics

R. Deverell-Smith, Journal of the Society of Dyers and Colourists, page 328, Vol. 65, No. 7, July, 1949.

The following objectives should be kept in mind in designing a method of surface dyeing a plastic—

(1) The natural surface of the material must be retained.

(2) Surface distortion of the plastic material must be avoided.

(3) The method of dyeing should be free from industrial hazards.

(4) Shrinkage or distortion of the molded or shaped article must be avoided, if possible.

(5) Maximum fastness to general conditions of use should be obtained.

The dye must be transferred from a substantially aqueous medium to the surface of the plastic. Acid dyes have chemical affinity for nylon and casein plastics. Basic dyes are used only for specialized applications. Water-repellent types of plastics are normally dyed by process similar to that used for cellulose acetate rayons where physical absorption of the dye occurs. Vat dyes may also be considered for surface dyeing of plastics. The standing bath technique is to be preferred. When a satisfactory laboratory method has been developed, certain precautions must be observed in transferring to a commercial scale:

(1) Dyebath equipment should be inert to dyes.

(2) There should be free access of dye liquor to all surfaces.

(3) Plastics should be thoroughly clean.

(4) The dye must be thoroughly dispersed or dissolved in the dye liquor.

(5) The plastic should be completely submerged in the dye liquor and after dyeing should be plunged into cold water where it is rinsed.

Detailed methods of dyeing are given for the following plastics: polymethyl methacrylate, cellulose acetate, cellulose nitrate, plasticized vinyl plastics and polythene, casein, urea-formaldehyde and phenol-formaldehyde, polystyrene and nylon.

Origin and Identification of Damage to Textile Fibers

E. Kornreich, Journal of the Society of Dyers and Colourists, page 341, Vol. 65, No. 7, July, 1949.

This paper discusses some of the causes of damage as it arises in manufacture, in the home, or in the laundry, the action of the damaging agents, and some means of identification of specific types of damage.

Fire-Retardant Coatings for Fabric-Covered Aircraft

S. G. Weissberg and G. M. Kline, Industrial and Engineering Chemistry, page 1742, Vol. 41, No. 8, August, 1949.

Stimulated power-plant fire tests of doped fabrics coated with fire-retardant coatings, conducted under wind-tunnel conditions, demonstrate that it is possible to increase the critical time interval between the instant of first contact of fire and fabric and the instant of fabric destruction, from the present value of 2 seconds with cellulose nitrate dope or 6 seconds with cellulose acetate butyrate dope to 12 seconds with a fire-retardant coating applied over cellulose acetate butyrate dope. A laboratory method for the quick evaluation of relative performance of fire-retardant coatings is described; this test will facilitate the further development of fire-retardant coatings. The protective action of fire-retardant coatings on cellulose nitrate dope is too small to be of any value. The results of outdoor exposure tests reveal several fire-retardant coating systems with good weathering characteristics which are recommended for further development. The use of a mixture of boric acid and borax as fabric impregnant, while effective as a fire retardant, has a deleterious effect on adhesion of dope to fabric which is apparent on outdoor exposure.

Rate of Dyeing as an Aid to the Classification of Direct Dyes on Viscose Rayon

W. Armfield, Journal of the Society of Dyers and Colourists, page 352, Vol. 65, No. 7, July, 1949.

Rate-of-dyeing experiments are described with direct dyes on viscose rayon yarn. Sodium chloride is added gradually to the dye liquors, at a constant rate throughout the whole dyeing time of two hours. The measured dye absorption is plotted against time of dyeing. This method of salting is comparable with works practice, and gives rates-of-dyeing curves very different from those obtained by making the electrolyte addition at the start of dyeing, a procedure not used commercially.

These rate-of-dyeing measurements show that dyes cannot be classified satisfactorily by rate of dyeing alone, but that once dyes have been separated into classes according to their levelling and salting behavior, rate-of-dyeing measurements then provide a means of further refinement. Eighteen Class B dyes tested showed that rate-of-dyeing measurements provide a means of predicting the compatibility of dyes in mixture.

From the rate-of-dyeing curves, the time in minutes is read off corresponding to one-quarter, one-half, and three-quarters of the final exhaustion value E for each dye. These times are tabulated under the headings $t0.25$, $t0.5$, $t0.75$, and indicate numerically the dyeing rate of a dye. The degree of compatibility of two or more dyes is assessed by comparing $t0.25$, $t0.5$, $t0.75$, for each dye. Any single time of dyeing is not sufficient to indicate rate of dyeing, since two dyes may have the same dyeing time at any one point on the curve, but they may not necessarily agree at other points.

An Improved Multipurpose Abrasion Tester and Its Application for the Evaluation of the Wear Resistance of Textiles

R. G. Stoll, Textile Research Journal, page 394, Vol. XIX, No. 7, July, 1949.

The author's abstract follows:

On the basis of a systematic consideration of the mechanics of fabric wear and abrasion and extensive experimentation with various test methods and machines an improved multi-purpose abrasion tester has been devloped under the research program of the Quartermaster Corps. This work was carried out jointly by the Quartermaster Textile Materials Engineering Laboratory and the Textile Section of the National Bureau of Standards. The apparatus is capable of quantitatively measuring resistance to flat-, edge-, and flex-abrasion under carefully controlled conditions, producing macro- and micro-wear patterns which are the same as those obtained in actual wear. Materials tested in the machine are abraded to an end-point which is quantitatively defined and independent of individual judgment. Deviations in test results due to the machine are insignificant compared to the deviations of the samples themselves. A correlation has been found to exist between accelerated combat-wear data and results obtined on the new tester.

Proceedings of the
American Association of Textile Chemists and Colorists

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COMMITTEES ACTIVE ON CONVENTION PLANNING

ALL sub-committees for the 28th National Convention are now functioning and with preliminary planning completed, all categories of the convention program are taking shape, according to Walter F. Fancourt, 3rd, W. F. Fancourt Co., General Convention Chairman.

The Chairman and Vice-Chairman, Ernest E. Rettberg, Jr., of Scholler Brothers, Inc., are holding periodic meetings with the various sub-committees. Much of the essential material for the initial program was compiled at a recent meeting of the Printing and Personnel Service Committee of which Prof. P. Theel, of the Philadelphia Textile Institute, is Chairman.

Many sub-committee chairmen have visited the Chalfonte-Haddon Hall and were impressed with the excellent facilities this huge hotel offers for holding a convention "under one roof". Atlantic City, the "Playground of the World" has much to offer in the way of sight-seeing and sports entertainment but for those inclined to "take it easy", the Chalfonte-Haddon Hall offers its own handball courts, movie theater and other leisure-time facilities.

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Alden D. Nute

Intersectional Contest Committee, Rhode Island Section

ALDEN D. NUTE, technical sales division of the textile resin department, American Cyanamid Company, is Chairman of the Intersectional Contest Committee for the Rhode Island Section.

Mr. Nute was graduated from Massachusetts Institute of Technology with a B.S. in Chemical Engineering. He was with the American Printing Company in Fall River, Massachusetts, for fifteen years during which period he held in turn the positions of chemist, chief chemist, assistant superintendent, and director of research. For four years he acted as assistant superintendent of the Print Works Division of Pacific Mills in Lawrence, Massachusetts. He became associated with American Cyanamid ten years ago and is particularly active in the development and application of special resins to textiles.

Other members of Mr. Nute's committee are:

Fred R. Tripp
Mount Hope Finishing Company
James C. Shore
Glenlyon Print Works
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Airedale Worsted Mills, Inc.
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Sayles Finishing Company

The title of the paper which will be presented by either Mr. Nute or Dr. Parks at the Intersectional Contest in Atlantic City this October is: "The Properties and Applications of Resin Forming Acid Colloids". The judge representing the Section will be Peter J. Ariente, Sayles Finishing Company.

Old Reporters Wanted

TO meet the requirements of libraries for complete volumes of the *American Dyestuff Reporter*, the Association needs the following issues:—

Year 1937, No. 2, Jan. 25
Year 1937, No. 15, July 26
Year 1937, No. 19, Sept. 20
Year 1938, No. 3, Feb. 7
Year 1938, No. 16, Aug. 8
Year 1939, No. 4, Feb. 20
Year 1940, No. 17, Aug. 19
Year 1942, No. 1, Jan. 5
Year 1943, No. 24, Nov. 22
Year 1946, No. 1, Jan. 14

For copies of these issues, mailed to the Secretary, A.A.T.C.C., Lowell Textile Institute, Lowell, Mass., fifty cents each and postage will be paid.

CALENDAR

SOUTH CENTRAL SECTION
Outing: September 9 to 11 (Lookout Mountain Hotel, Chattanooga).

PHILADELPHIA SECTION
Meetings: September 16, November 11 (Kugler's, Philadelphia).

PIEDMONT SECTION
Meeting: November 5 (Charlotte Hotel, Charlotte, N. C.

HUDSON-MOHAWK SECTION
Meetings: September 16, November 18.

NEW YORK SECTION
Meetings: September 23, November 18 (Swiss Chalet, Rochelle Park, N. J.)

NORTHERN NEW ENGLAND SECTION
Meetings: September 16 (Andover Country Club), November 4 (Lowell Textile Institute), December 2 (Boston).

COUNCIL
Meetings: September 9 (The Warwick, New York), December 9 (New Yorker, New York).

RESEARCH COMMITTEE
Meetings: Sept. 9, Dec. 9.

NATIONAL CONVENTIONS
1949: October 13 to 15, Chalfonte-Haddon Hall, Atlantic City.
1950: September 28 to 30, Portsmouth, N. H.
1951: October 18 to 20, Statler, New York.
1952: Boston.

Jackson A. Woodruff

Intersectional Contest Committee, Philadelphia Section

JACKSON A. WOODRUFF, American Viscose Corporation, is Chairman of the Intersectional Contest Committee for the Philadelphia Section. Mr. Woodruff attended the U. S. Naval Academy, 1930-34, and Columbia University in 1934. He was employed by Sidney Blumenthal Company, 1935-43, in the Research Department. He started the pilot plant laboratory and research in continuous dyeing. He did further work on spectrophotometric evaluation of dye solutions. Mr. Woodruff has been employed by American Viscose Corporation since 1943, starting as a member of the Dyeing and Finishing Division staff. He was placed in charge of the Textile Development Laboratories Division in 1947 and took over, in addition, the Dyeing and Finishing Division in 1948. His field of work is in application research on dyeing and finishing problems.

Other members of Mr. Woodruff's committee are:

Arthur W. Etchells
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E. C. Neussle
Rohm & Haas Company
Arnold L. Lippert
Joseph Bancroft Company
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Calco Chemical Division, American Cyanamid Company
E. McCoy
Monsanto Chemical Company
T. R. Foltz
Philadelphia Textile Institute
P. Theel
Philadelphia Textile Institute

The paper, which will be presented by Mr. Woodruff at the Atlantic City Convention in October, is entitled: "Dimensional Changes Occurring in Spun Viscose Rayon Fabrics During Processing on Ma-

chinery Used in Shrinkage Stabilization Finishing". Dr. Onslow Hager will be the judge representing the section.

—♦ ♦—

Meeting Dates, New York Section

THE following dates have been designated for meetings of the New York Section for 1949-50. Where more than one date is mentioned the selection is not yet definite.

September 23 (Kohler's Swiss Chalet, Rochelle Park, N. J.)

November 18 (Kohler's Swiss Chalet, Rochelle Park, N. J.)

January 13 or 20 (Hotel New Yorker, New York)

February 24 or March 3 (Hotel New Yorker, New York)

April 7 (Kohler's Swiss Chalet, Rochelle Park, N. J.)

May 5 or 12 (Kohler's Swiss Chalet, Rochelle Park, N. J.)

June 16 (Outing)

Rain Tester Blotting Paper

In the interests of uniformity and reproducibility in making tests with the A.A.T.C.C. standard Rain Tester a specially manufactured lot of blotting paper has been made exclusively for textile work. Satisfactory inter - laboratory tests have been completed on a representative cross-section of this lot, and the paper is now available for purchase from:

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RICHMOND, VA.

Attention: J. S. WALDEN, SALES DEPT.

Stock Size:—24"x38"—240 lb. per ream (500 sheets).

Minimum Order: 25 lb. (Approx. 50 sheets —24"x38").

Price (Subject to change):

For ¼ ream—27c. per lb.

For less than ¼ ream—34c per lb.

The manufacturer is willing to cut these sheets to 6"x6" or any other desired size at a charge of $1.00 per ream ($1.00 minimum cutting charge). When ordering, specify "WHITE A.A.T.C.C. TEXTILE BLOTTING" and send order direct to the manufacturer.

In the past it was found difficult to obtain reproducible results or good correlation in inter-laboratory tests through the use of blotters furnished by different manufacturers or even by the same manufacturer. Because of this situation arrangements were made solely with the above company for the manufacture of a special lot of uniformly - made blotting paper. The manufacturer guarantees to furnish a continuous supply of uniform paper.

EMPLOYMENT REGISTER

This column is open for four insertions per year, per member, without charge. Blanks can be obtained from, and filed with, the Secretary of the Association. Lowell Textile Institute, Lowell, Mass. It is understood that these will be open to inspection by prospective employers, who can obtain further information from the Secretary.

49-1

Education: B.T.C., Lowell Textile Institute.

Experience: Laboratory technician, cost research, quality control, following army service.

Age 26; married, references.

7-11, 7-25, 8-8, 8-22

49-19

Education: B.S., Texas Tech. College, Chem. & Dye.

Experience: Cotton finishing.

Age 31; married; references; Southwest preferred.

7-11, 7-25, 8-8, 8-22

49-20

Education: B.S. in Textile Chemistry.

Experience: Textile Chemist and Colorist.

Age 32; married; references; New England preferred.

7-11, 7-25, 8-8, 8-22

49-21

Education: Graduate, textile technology, New York State Inst. of Applied Arts & Sciences, class valedictorian.

Experience: summer work during education.

Age 23; unmarried; will go anywhere.

7-11, 7-25, 8-8, 8-22

49-22

Education: Graduate of Bradford Durfee Technical Institute, with honors.

Experience: Summer in textile mill laboratory.

Age 20; girl; unmarried; references; vicinity of Providence, R. I. preferred.

8-22, 9-5, 9-19, 10-3

Open Forum to be Held by Rhode Island Section

AN Open Forum is being arranged for the November meeting of the Rhode Island Section. It is planned to have an imposing group of experts present to discuss any dyeing, printing and finishing problems which may be presented. Members are invited to submit questions by September 15th and they should be sent to:

Mark Weisberg
Alrose Chemical Co.
P. O. Box 1294
Providence, Rhode Island.

This will be a dinner meeting.

—♦ ♦—

Analytical Methods for a Textile Laboratory

Through the generous efforts of a committee headed by Professor Theel of the Philadelphia Textile Institute, "Analytical Methods for a Textile Laboratory", have been completely rewritten, and are now published in an attractive bound volume of 287 pages, in form similar to the older Year Books. Contents are as follows—

"General Instructions; Standard Solutions; Reagents; Methods of Sampling; Methods of Analysis of Chemicals; Determination of Finishing Materials and Determination of Resins and Resin Finishes; Identification of Dyestuffs on the Fiber; Determination of Textile Fibers; Useful Tables and Calculations; Index."

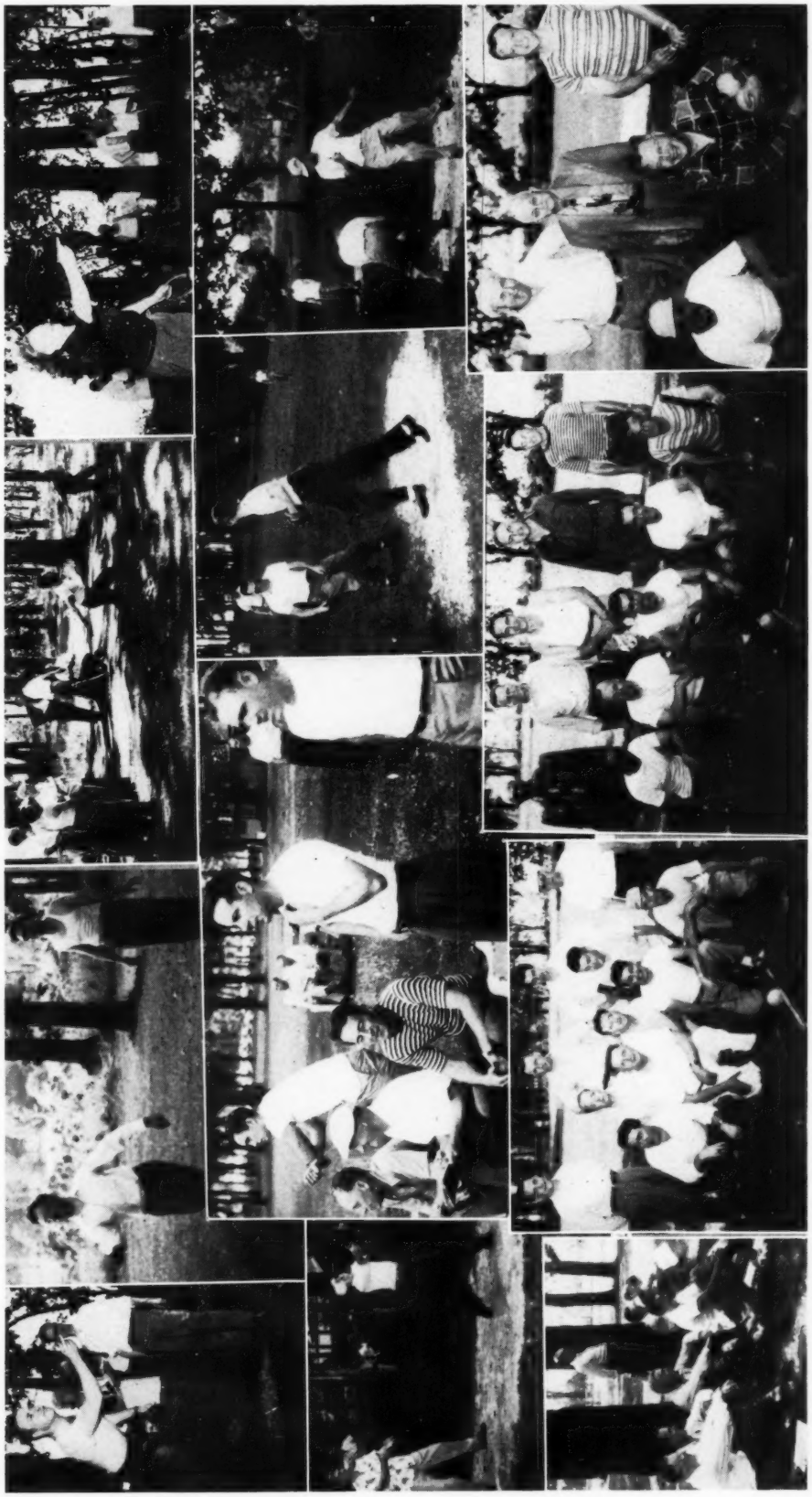
This book can be obtained from the Secretary, A.A.T.C.C., Lowell Textile Institute, Lowell, Mass., postpaid, for six dollars. To members of the Association, for one copy only, the price is five dollars.

MID-WEST SECTION
ANNUAL OUTING

LAKE LAWN, WISC.
JUNE 18, 1949

(SEE JULY 25
ISSUE P554)

Mid-West Section Annual Outing



TOP: Horseshoe Pitching Deluxe
CENTER: Softball Game Highlights
BOTTOM (l. to r.) Spectators, Salesmen's Team, Millmen's Team and Officials

Rhode Island Section—

DIRECT DYE SELECTION*

JACKSON A. WOODRUFF

American Viscose Corporation, Dyeing & Finishing Division

ONE of the most important duties of a dyer or the colorist, if the two are separate functions, is the selection of dyes to be used on specific textile materials. Such selection is not as simple as going to the drug store and asking for a package of household dye. In that case, the selection has already been performed and the dyes mixed with salt and packaged to give as level dyeing a combination as the housewife would want. In textile dyeing, there are two major requirements of the dyes to be selected for use and they should be considered in order. (I) What fastness specifications are to be met? (II) Will the dyes perform satisfactorily for the normal application methods of the dyer? Actually, a third important property of dyes must also be considered and that is the cost of the dye. The third consideration is left strictly to the individual.

Fastness Specifications

In answering the first question, the shade cards from the dye manufacturers offer a starting place in giving the test results of the fastness properties of the individual dyes. It is an unusual dyehouse, however, that can find all the dyes it possesses described in shade cards. Somehow, those letters after the dyes are often not quite the same as in the card. Working in conjunction with the shade cards should be the colorists file based on the performance of production dyeings. This file actually should be, in any dyehouse, the most valuable tool on which to base selection. If properly kept and indexed, it should provide after a few years' time nearly all the answers except when unfamiliar dyes or fiber combinations bring up problems extending beyond the files experience.

Still, on the first question of fastness specifications, it should be mentioned that not a few dyers send to the dye suppliers many of their shades and specifications to be matched in order to obtain the benefit of the experience and knowledge which the suppliers should have in order to best sell their products. Without being critical of this procedure, it can be said that such laboratory matching and testing does not give the whole story as concerns production and must be balanced with trial and experience under one's own plant conditions. The dyer must also not fail to give the supplier all the necessary specifications or the best job cannot be done.

Dye Performance

Moving on to the answers to the second question, "Will the dyes perform satisfactorily for the dyer?", one comes into the field in which much more work remains to be done. The dyer's experience is obtained the hard way, as his work is all production. His failures are redyes and costly and his successes are expected as a matter of course. It is toward the objective of lessening the number of failures and explaining the reasons for them that technical minded dyers in many laboratories have tried to obtain greater intimate knowledge of dye properties and how best to classify them for improved selection. A great deal of this type of work, especially by the dye suppliers, has never been published except in the brief results shown in shade cards. Probably the best known initial published work is that by C. M. Whittaker, and later by J. Bolton, T. Morton and others in England. The Society of Dyers and Colourists formed a committee a few years ago for the purpose of concerted action in the further exploration of methods for classification of direct dyes on cellulose. Quite a few results have been given. Although the number of dye manufacturers in England is not large, they too have been very active in publishing constructive criticism of dye selection as well as in contributing data themselves. All these references to the work in England have been mentioned because there have not been many publications in this country of like scope or intention. The apparent trend in the United States has been to give general methods of application of various dyes without explaining why, and to let the dyers ask specific questions of the dye suppliers as a business proposition. In the past few years, the meetings of the A.A.T.C.C. have provided a greater interest in dye classification and selection, and in several institutions or laboratories even more fundamental studies of dyeing are under way. This fundamental work may well point out the reasons for the present limitations in dye selection and help fill in the missing information.

Approximately two years ago, a method of direct dye classification was commenced at the Dyeing and Finishing Division's Laboratory in the American Viscose Corporation. The primary objective was to provide data for aid in viscose rayon cake dyeing by using Whittaker's classification grouping on United States dyes. The use of this data in other forms of dyeing was also visioned as of help in general problems. The groupings of the dyes were made on the basis of apparent diffusion penetration of direct dyes through a solid block of water swollen viscose and on the rates of exhaustion of single dyes, with and without salt present, in viscose staple fabric dyeings. The actual details of the method of testing, classification and definition of A, B, and C dyes, and a list of approximately 175 dyes so tested were given in the October 18, 1948, issue of the *American Dyestuff Reporter*. The measurements of diffusion, penetration and

* Presented at meeting, Rhode Island Section, April 22, 1949.

of the exhaustion rates were all made on individual dyes and not combinations. Work has been continued in this laboratory on the application of combinations of dyes selected for predicted compatability in dyeing. Much of the application dyeing has been done on a single cake machine, and the results so far have been somewhat better than ¾ successful in prediction.

It has been shown (especially by Lemin, Vickers, and Vickerstaff) that the prediction of the behavior of dyes in combinations is often faulty. However, in making use of the data at hand it has been found that in nearly all cases when no peculiarities are noted in the dyes, and the diffusion penetration and exhaustion rate measurements are alike, the results are usually as expected.

In the dyeing of green shades lie the greatest difficulties. These are in large part due to the scarcity of yellow dyes which can be described as normal in their properties. In some blue and yellow mixes, a tendency to form a precipitate or agglomerate has been noticed during the dyeings, especially at points where the dye liquor flows rapidly through a narrow but fairly long slit such as is formed by the cake cover in contact with the cake holder. The presence of some anionic softeners or soap like finishes in the dyebath often exaggerates this effect. This phenomena is mentioned because it is one of the reasons why combinations of dyes do not always work as anticipated. It may be said also that it is sometimes difficult to explain why some predicted misfits do work well.

Results of Classifications

What can be reported as successful results of the use of dye classification? It has been found that the prediction of behavior of selected dyes is of great aid in viscose cake dyeing, especially in predicting Class "A" behavior. It has been found from laboratory work that dye concentration, salt, concentration, temperature of the bath, volume ratio, dyeing assistants, pH^+ of the bath, reducing influences, and many other conditions can affect predictions. Let us take as an example Purpurine 4B, C.I. No. 448. This is classified by the writer as a Class "C" dye, and has a high rate of exhaustion in the presence or absence of added salt. It is interesting that the diffusion penetration is hardly affected by the addition of salt. Because it is a Class "C" dye, one would predict that in dyeing cakes with inside to outside flow it would show a tendency to exhaust to a deeper shade on the inside and middle of a cake and be light on the outside. However, a dyeing of 4% Purpurine 4B conc. gives a beautifully level result. Reducing the concentration to a ¼% dyeing, the outside of the cake shows as light and streaky. In a 1/10% dyeing, the outside is quite light and very streaky. It is not difficult to form a plausible theory of why this should happen. Purpurine 4B shows a rapid rate of exhaustion on viscose rayon whenever a fresh surface is exposed, and this dye happens to have a slow diffusion penetration. Suppose the 4% dyeing does exhaust quickly where fresh sites are available. If it cannot also penetrate quickly into the fibers, then the excess absorption on the surface is not likely to be bound tightly, and a portion of the dye will go back into the dyebath and move to sites where the competition is not so keen. This moving around will result in a level dyeing. In the case of low percentage dyeings, there is a rapid exhaustion to freshly exposed surfaces, but the number of available sites is sufficient in the inside and middle of the cake to cause fewer contacts with the outside of the cake, and the dyeing result is unlevel. This dye has been the subject of much investigation, and it has been shown that in a pure state (without salt) it has very little exhaustion on cellulose unless electrolyte is added to the bath. This means that actually it is a Class "B" dye, but as it is sold commercially it has Class "C" characteristics.

Another well known red dye is the Solantine Red 8BLN type which is listed as Class "B". This dye is used a great deal in direct dyeing, and often is troublesome in combinations made without selection of dyes. It is a slow exhausting dye in the presence of salt concentrations which would cause rapid exhaustion of many other dyes. One look at the exhaustion rates would tell that when it is mixed with C.I. 533, Diphenyl Blue 4BL, a dyeing would start out on the blue side, and finally to all practical purposes the blue would be exhausted and most of the Red 8BLN would still be in the dyebath. Both of these dyes are Class "B", but their exhaustion rates are sufficiently different for them to show different responses to time and salt concentration.

Another well known dye is Red 7BL, C.I. 278. This is an example of a Class "A" dye which one wishes were more common. Under normal conditions, in light to medium shades, it handles beautifully and yet has enough water and light fastness to make it very useful. In heavy shades, care must be used to avoid migration during drying but, otherwise, it is exceptional in good level dyeing qualities. The high rate of diffusion penetration means that even if it be applied unevenly at the start of a dyeing, it can be levelled easily by prolonging the dyeing at high temperature. There is no point in starting a dyeing with C.I. 278 at low temperature, as it will not have its high diffusion penetration until close to 180°F., then will continue to improve up to the boil. It might be pointed out that when a dye shows a low diffusion penetration at the boil, as does Orange ERL (Prototype 73), then the temperature of dyeing (all other variables being held constant) does not make very much difference, as its diffusion penetration is not going to change much anyway.

As an example of the use of classified data, it has been found possible to develop tests for the presence of modified viscose forms which have a random appearance in the best of staple fiber production. Cemented filaments or splinters, as these modifications are sometimes called, have been found to dye very rapidly with Class "A" dyes, but much more slowly with Class "B" dyes. Therefore, when a mass of staple fiber containing such defects is placed in a boiling dyebath of Red 7BL, C.I. 278, and Sol Aqua F. Blue L for a period of 5 minutes and rinsed, it will be found that a medium to full red has dyed on the cemented filaments, but the good staple has only a light blue tint. Such splinters stand out easily for detailed counting of their few numbers within a known weight of staple. The same difference in classification behavior can be predicted in similar dyeings, such as used by Goldthwaite, on mature and immature cotton. In an analogous vein, the writer has made dyeings of two specially prepared viscose filaments, one having a thick "skin" and one no apparent "skin". Since it is believed that this so-called "skin" is of increased density, one would immediately suppose that the dye with the high diffusion penetration would be the one to color the "thick skin" filament before the more slowly moving dye could enter. Actually, the reverse is true.

It should be stressed in all classification work that each dye is a different chemical and as such is going to have individual habits unlike any other chemical. There are, however, many points of similarity between those of one chemical grouping or configuration, and eventually it should be possible to understand why each reacts in a specified way to changes in concentration, temperature, salt, pH^+, other dyes, dyeing assistants, and differences in fibers being dyed.

To broaden the application of classifications, the following dyeing systems will be discussed:

I. Jig alone
II. Dyebeck alone
III. Pad alone
IV. Pad-jig
V. Pad-beck
VI. Skein

I. JIG ALONE—In jig dyeing, it is normal to scour and dye in either two baths

or one. In any case, contact of the fabric with the dye is accomplished by the passage of the fabric through the dye liquor, rolling up and repeating. This means very poor circulation of the dye liquor through the interstices of the yarns. Therefore, if the dye is to penetrate the yarns, it must do so more or less on its own power. The natural classification for this work is the Class "A" dye. Where the best levelness and penetration of a tight fabric is essential, these dyes are the only ones which will do the job. If it is necessary to use Class "B" or "C" dyes, then much longer periods of dyeing will be needed and very careful salt adds must be used. On the jig, when Class "B" or "C" dyes are used, it is also necessary to check the exhaustion rates or be prepared for trouble in matching shades.

II. DYEBECK ALONE—In the dyebeck circulation of liquor is much better than on a jig, and on loose and open fabrics a wide choice of dyes is practical without too great risk. Attention should still be paid to using dyes of similar properties and to knowing the salt sensitivity. It is with those fabrics which are difficult to penetrate evenly that it is extremely useful to know whether A, B, or C dyes are being used. Class "A" allows shorter time of dyeing with much better penetration. Class "B" requires careful salt additions spread over a longer time. Class "C" requires a long run at low temperature, coming up to the boil slowly so that circulation can accomplish its part towards levelling out the dyeing. Examples of Class "A" and Class "B" dyes on a rather difficult gabardine are shown. Close examination will show the improved levelness of the Class "A" dyeing. In making adds to shades on the dyebeck, the Class "A" dyes are very helpful, especially when considerable salt may be present. Certain Class "B" dyes having low exhaustion, even with salt, are also useful for the same purpose.

III. PAD ALONE—The story of pad dyeing brings in other dye properties which have been fairly well studied in production. Since pad dyeing allows little time for absorption of dye preferentially from the dye liquor, the depth of shade possible depends on the concentration of dye in the padding liquor, all other variables being assumed constant. Normal volume ratios are not met in padding. Instead of weight of fabric to weight of water in the dyebath, one deals with the concentration of dye solution, the degree of liquid pick-up, and the substantivities of various dyes. Class "A" dyes are excellent for coverage, fair for depth, and usually good for solubility. The wicking tendency of these dyes gives the improved coverage. Class "C" and Class "B" dyes also can be used in straight pad dyeing, and fair depths of shade can be obtained with those having good tinctorial value and solubility. In the high concentration of the pad liquors, there is little need of added salt for exhaustion of Class "B", but a long pad bath and high temperatures can be used to increase the depth of shade by preferential exhaustion of the dyes instead of a specific liquid pick-up. Such conditions produce difficult feed liquor adjustments because of inequalities in the exhaustion properties of direct dyes.

IV. PAD JIG—Combining the pad and the jig allows the maximum flexibility in choice of dyes. Classes "B" and "C" can be used for even light shades without showing poor penetration or unlevelness. However, the fabric should be prepared before padding so that each yarn will be in a condition to accept an equal amount of dye liquor from the pad. Because of the low diffusion penetration of "B" and "C's", they will not move far from their original positions coming from the pad when treated in a salt bath on the jig. Class "B" dyes are not quite as easy to handle as the "C", because they require more salt in the jig to hold them in place. This extra salt can cause difficulties if adds are necessary to bring the fabric to shade. With the use of Class "C" dyes for padding and following with a low salt content jig bath, Class "A" dyes can be used for shading with minimum trouble in penetration and unevenness of dyeing. Class "A" dyes alone are not often used in pad jig, because their advantages are mainly offset by their lack of water and perspiration fastness.

V. PAD BECK—In dyeing fabrics by the pad-beck method, the advantages of both pad and the beck can be realized. It is the only quick way to obtain good penetration on the beck with difficult to penetrate fabrics and Class "B" and "C" dyes. The methods of obtaining penetration with "B" and "C" dyes on the beck alone have been previously mentioned, and require time and controls which are largely eliminated by the combination of pad-beck. The levelness penetration of Class "A" dyes on the beck alone can easily be surpassed by "B" and "C" dyes through the pad-beck method. Since a fair proportion of mills are not familiar with this method, a brief description follows.

Pad the goods with enzyme and roll up for a minimum of three hours. Return to an open width scouring machine and dryer. This is a good procedure but, to go one better, in many cases the dye can be padded in with the enzyme so as to eliminate the drying operation. Enter the goods into the dyebeck with the liquor at a temperature between 120°F. and 140°F. The liquor should contain approximately 10 to 15% common salt on the weight of the goods. Run for 20 to 45 minutes at 140°F. and then bring to the boil in 30 minutes. Run 15 to 45 minutes and sample. There are many variations to this procedure, with the padding, salt adds, and the cycle more or less common to all. One can readily see how the Class "B" or "C" dyes would fit this picture, since there is little tendency to bleed into the dyebath and the dyes are developed to shade at, or very near, the position in which they were placed by the padding.

It should be apparent that there would be little advantage in applying Class "A" dyes by this method as far as levelness and penetration are concerned. Although if desired they will be satisfactory.

VI. SKEIN—In shifting to skein dyeing and in general to the Cascade type dyeing machine, the classification of dyes is again handy to know. In this type of dyeing, levelness depends in great part on the evenness of circulation and the control of rate of exhaustion. The better the evenness of circulating dye liquor, the less attention has to be paid to control of rates of exhaustion. The direct dyes should be applied for the most part in not more than 20 minutes. This leaves no time for diffusion penetration to level out an uneven dyeing, which can be caused by too rapid exhaustion during the first few minutes of dyeing. This type of set-up fits the Class "B" dyes very well, since they can be controlled in their exhaustion by the addition of salt. A common method, and a good one, is to start the dyeing with a 1 to 2 minute wet out in dye, and scour at a temperature close to 180°F. The steam need not be kept on, and the dissolved dye can be added to the dyebath directly before the start. After three minutes circulation, the salt can be added in four 3 minute intervals. Five minutes after the last salt, the dyeing should be ready for sampling. In dyeing a shade for the first time the dye cycle should be stretched out a bit, but with experience on a shade it can be cut down to as low as ten minutes. A few minutes saved here and there is not of much advantage unless an improvement in winding qualities is needed.

In closing, the method of direct dye classification is not a cure-all of dyeing problems. Any dyer present could, with a little study, find examples of unpredictable behavior. The classification effort is an attempt to bring to a confused picture some clarity and definition. It is felt that the work has contributed to the understanding of dyes and is well worth continuing.

TRADE NOTES • NEW PRODUCTS

• New Research Program Helps Lick the Summer Slump

A new research and consulting service for textile wet processors has helped Amalgamated Chemical Corp., Philadelphia, to offset a slowdown in orders, according to Harold B. Dohner, president. Shown is the air conditioned research and development laboratory completed this summer in time for the firm's 10th anniversary. Hillary Robinette, Jr., new research director, is at left. The analytical and control laboratory is under the supervision of William Boesler, Jr. The Amalgamated southern office in Greensboro, under the direction of Robert A. Bruce, vice-president and treasurer, was completely modernized a few months ago. Other representatives of the firm are Charles A. Seel and George C. Harkins. John M. Jester, the Company Secretary, supervises manufacturing operations.

• Pfizer 100th Anniversary

100 years ago in the then rural Williams urg section of Brooklyn, N. Y., Charles Pfizer and Charles F. Erhart formed a partnership for the production of fine chemicals, which has grown to the status of one of the leading manufacturing chemists in the country. Today, Chas. Pfizer & Co., Inc., is said to possess a world-renowned reputation as basic producers of a large group of fine chemicals and to be the largest producer of antibiotics which include penicillin and streptomycin. Manufacturing facilities have expanded continously over the years and today Pfizer has four large modern plants at Brooklyn, N. Y., Groton, Conn., Terre Haute, Ind., and Maywood, N. J.

Although there were few tests and controls in the early days, one of the fundamental concepts of the business was to establish positive methods for the control of purity, quality and potency.

Some of the products manufactured during the company's first decade included santonin, iodine preparations, mercurials, borax, boric acid, refined camphor, and the tartars. Today, the extensive list of Pfizer chemicals includes, as well as some of the early products, antibiotics, vitamins, citrates, bismuth, gluconates and others.

Pfizer set up a special research laboratory in 1914 to investigate the domestic production possibilities of citric acid as one of the first ventures into the field of vegetative fermentation. Its success opened a new and wider field for the production of fine chemicals by fermentation, a field in which Pfizer is said to hold an eminent position today.

During the first world war, Pfizer made many contri utions at a time when America was dependent on her own sources of chemicals and drugs. Pfizer production during these war years resulted in the fulfillment of 85 government contracts, it is claimed. Following the war Pfizer enlarged its research activities on fermentation and also developed a program directed toward the production of chemicals by organic synthesis. In 1929, gluconic acid was made available as a fermentation product at a price which is said to have warranted a more widespread application, and since that time Pfizer has steadily broadened the use for fermentation methods to produce fine chemicals

Today, research is one of the most important phases of Pfizer's activity. Two special groups—biological and chemical research—work independently but with a common, coordinated goal. Since the overall objective is to find new or better ways to manufacture fine chemicals, the results are often combined in processes involving both fermentation and organic synthesis.

• Dearborn Surface Active Agent

Dearborn Chemical Company, 310 S. Michigan Avenue, Chicago, has announced the formulation of a new surface active agent, tetra-naphthenoyl triethylene tetramine, which has commercial possibilities as a modifier, plasticizer or additive. It is an acylation product of triethylene tetramine with naphthenic acid, a very high viscosity oil, dark in color, insoluble in water but soluble in a variety of organic solvents. It has an acid number of approximately 30.

This new modifier is said to have uses as a conditioning agent in the manufacture of textiles, as an additive in pulp and paper manufacture, as a flotation agent in minerals separation, as an oil demulsification agent and insecticide additive. It is commercially available in technical grade. Samples are available upon request.

• New Dye Fix Compound

A new, low-cost, substantive compound to fix direct dyes has recently been placed on the market by Arnold, Hoffman & Co., Inc. of Providence, R. I. The new product is named Ahcofix C*.

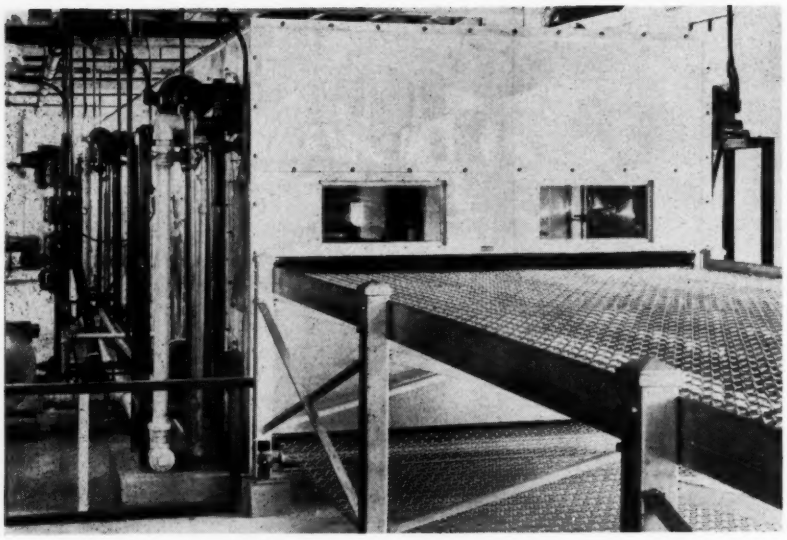
Chief advantage of Ahcofix C is that when added directly to urea-formaldehyde or melamine-formaldehyde resin baths, viscose rayons and cottons are said to achieve washfast properties comparable to vat dyed finishes.

Tests show that direct-dyed fabrics treated with this new substantive compound do not bleed, even when washed for 30 minutes in a .5% soap solution at 140 degrees, it is claimed.

Available in liquid form for instant solubility, Ahcofix C contains no copper salts. This is desirable because complete shade control is claimed possible; the necessary copper salt being added in the exact quantities required.

Cost-wise, this new Arnold, Hoffman product is said to offer several opportunities for production economies. Initial cost is lower because Ahcofix C is domestically produced and secondly, inexpensive direct dye processes can be used instead of more costly vat dye processes.

* Trademark Registered.



Process Heating Drying and Curing Range

• Drying and Curing Range

The Process Heating Co., Inc., has developed a gas infra-red and high air velocity system for drying and curing latex backing on carpets.

The system incorporates gas infra-red generators as the source of convected and radiant heat and large volume fans with high velocity air jets as the means of impinging air as well as a stainless steel balanced spiral conveyor to convey the carpets through a two zoned 50′ insulated oven.

The drying and curing zones have separate exhaust systems for removing saturated air and volatiles, and indicating temperature controllers for maintaining uniform heat throughout the oven.

A "Premix" air-gas combustion system which is used for supplying fuel to the gas infra-red generators, includes a high pressure Turbo-Blower, automatic Butterfly air valves, atmospheric gas pressure regulators and aspirator mixers. Blast pilots, also with a Premix system, are employed to ignite the generators. These pilots are said to have automatic spark-plug ignition.

To meet Factory Mutual Requirements, safeguarding controls have been installed on both the oven and conveyor. This equipment includes safety shut-off valves, relays, air flow switches, and flame controls.

The temperature controllers actuate a motorized air valve, which not only modulates the oven temperature, but also is said to raise or lower the intensity of the radiant heat. The temperature of each zone is also independently regulated by means of butterfly air valves.

It is stated that this drying and curing range, primarily designed for the carpet industry, lends itself readily to such drying, baking and curing applications as the drying and curing of resins on textiles, baking of enamel on metal and plastic surfaces, drying of fur, setting of nylon, drying and baking of food products, curing of printed dyes on textiles, flashing of vynils on paper, drying of paper, etc.

• Laboratory Weights Available

The Ohaus Scale Corporation of Newark, New Jersey announces the availability of its new laboratory weights, packaged complete with stainless steel forceps in a Clear-View plastic case. The complete set (50 gram to 10 mg.) lists for $2.50 and is claimed to be ideal for every industrial use, schools and for students.

Because a clear plastic case seems to be overwhelmingly preferred, the new Ohaus weights are packed in the box with every weight in its proper place in a molded Bakelite insert. By using the insert, there can be no distortion, thereby eliminating sticking of the weights in each opening. The weights are said to be well protected and clearly visible, and will not slip out of place when the box is inverted. The complete box is claimed compact and attractive, and designed to fit easily into the drawer of an analytical balance case.

Each weight in this set is said to be individually adjusted to well within Bureau of Standards Class 'C' Tolerances, the accuracy required for test weights used by Sealers of Weights and Measures.

The weights from 1 to 50 grams are made of highly polished lacquered brass. Fractional gram weights are satin finished aluminum. The denomination of each weight is said to be clearly marked for identification. The forceps supplied

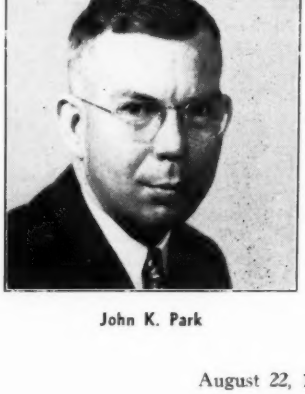
Ohaus Laboratory Weights

are made of highly polished stainless steel and were designed for easy handling of the smallest weights, it is claimed. The new Ohaus laboratory weights are available through laboratory supply dealers throughout the United States and Canada at $2.50 per set. Additional information and catalog material may be obtained by writing direct to the manufacturer, Ohaus Scale Corporation, 10-14 Hobson St., Newark 8, New Jersey.

• Fiberglas Names Park

Owens-Corning Fiberglas Corporation announces the appointment of John K. Park as manager of research and development for Fiberglas textile products. He will make his headquarters at the company's Ashton, Rhode Island, plant where the Fiberglas textile laboratory is located.

Mr. Park joined Owens-Illinois Glass Company in 1933, following his graduation from Purdue University. He had an active role in the early experimental work carried on in the laboratory of the Owens-Illinois Columbus, Ohio, plant which led to the production of glass in fiber form on a commercial scale. He transferred to Owens-Corning Fiberglas Corporation when the latter company was formed in 1938. During the past two years he has served as manager of product research and development at the Newark, Ohio, laboratories of Owens-Corning Fiberglas Corporation.



John K. Park

• S.O.C.M.A. Activities Planned

Fall meetings of the Synthetic Organic Chemical Manufacturers Association are planned for Wednesday, Septem er 14th, Thursday, October 13th, and Wednesday, November 9th. Under the chairmanship of Thomas H. Roberts (Arnold, Hoffman) the luncheon program committee is planning an interesting series of meetings.

The annual meeting and dinner of the Association is scheluled for Wednesday, December 7th and the following committee will be in charge: Herbert W. Smith (Carbide & Carbon), *Chairman,* Thomas H. Roberts, Clayton S. Shoemaker (Dow), and B. M. Van Cleve (Sherwin-W'lliams).

A naming committee consisting of Harold W. Dingee (Zinsser), *Chairman,* Alfred H. Egerter (Plaskon), Wm. F. George (Hooker), Mike Lemmermeyer (Aromatic), and Carl E. Van Winckel (Carwin) will select a slate of six candidates for the Nominating Committee for 1950 officers. These candidates will be presented for a vote at the October meeting.

• New Seat Covers

A new light-weight all nylon, washable fabric developed especially for automobile seat slip covers has been introduced by Burlington Mills Corporation. Fry Products of Detroit, a leading seat cover firm, has utilized the fabric to produce what is said to be the first completely washable, easily removable, all nylon slip cover in automotive history.

A novel demonstration which involved models, children and dogs equipped with leg make-up, ice cream, catsup, mustard and various other sundries was used in an attempt to prove the claims of the new product.

Three different weaves were introduced in twill, satin and oxford.

Another unusual feature outside of the cover's wash qualities is that the fabric is woven to permit the driver to slide in easily sideways under the wheel of the car but not forward and back.

• Speel Transferred

Henry C. Speel, for over a year a development engineer with the Central Sales Department, General Aniline & Film Corporation, has been transferred to Antara Products where he will be engaged in sales engineer work.

Mr. Speel has been in the market development phase of the chemical industry for the past 20 years, the last 15 of which have been devoted to the field of surface active agents. He will devote his time to sales engineer work on Antara Products complete line of anionic, cationic and nonionic surface active agents.

• Hilton-Davis Adds

Hilton-Davis, Cincinnati, has added a total of 31 new dyestuffs, fast bases and salts, naphthols and intermediates to its line since March 28, according to a new compilation of products issued with prices to customers last month.

A total of 89 items in these classifications are represented in the current listing as compared to 63 in the report issued in March.

Forty listed dyestuffs increased to 49; 12 fast bases and salts to 20; six intermediates to 10; and five naphthols to 10.

New naphthols are Hiltonaphthol AS-RL (Colour Index Pr. 312) Hiltonaphthol AS-E (C. I. Pr. 308); Hiltonaphthol AS-BG (Colour Index Pr. 385); and Hiltonaphthol AS-PH.

• Glyco Brochure

Esters of glycerol and many glycols and polyglycols are treated in a new brochure just issued by the Glyco Products Co., Inc., Brooklyn, N. Y.

This 24 page brochure gives tables of physical properties and uses of certain higher fatty acid esters. These are used in emulsifying agents, stabilizers, defoaming agents, surface-active agents and plasticizers in many industrial fields. Special grades of edible surface-active agents and emulsifiers are available for use in food products.

The polyglycol esters mentioned range from liquids of low freezing points to wax-like solids.

Large scale production of the esters at Natrium, W. Va., is said to have brought prices down below pre-war levels in tank cars.

Copies of this brochure are free for the asking to chemists and other technical workers.

• New Building at Georgia Tech

The 50th anniversary of the A. French Textile School of the Georgia Institute of Technology and the opening of its new $1,025,000 W. Harrison Hightower Textile Building with its almost $1,000,000 of equipment will be observed with special ceremonies on Friday, October 14, 1949, according to Professor Herman A. Dickert, Director of the School.

The celebration is being sponsored jointly by the Institute, the Georgia Tech Alumni Association, the Georgia Cotton Manufacturers Association, the Textile Education Foundation of Georgia, and others. It was through the efforts of these agencies, led by the Foundation, that state and private support was obtained for the construction of the new building and its equipping with the most modern textile machinery, instruments, classrooms, and laboratory facilities.

Preliminary program plans include guided tours through the building and an inspection of machinery and equipment, which will be described and demonstrated by representatives of their manufacturers. Following an informal luncheon in the Georgia Tech dining hall, opening exercises will be held in the auditorium of the new building. Official guests will include outstanding political, educational, financial and industrial figures.

Georgia Tech President and Mrs. Blake R. Van Leer will be hosts after the exercises at a tea and reception in the president's home given in honor of those making the new building possible. It is contemplated having a banquet in the evening which will be addressed by a speaker of international prominence.

On Saturday morning, October 15, the building will be open to the general public who will be given guided tours through the laboratories and other places of interest. The opening festivities will be concluded with the varsity football game between Auburn and Georgia Tech in the afternoon at Grant Field.

• Merlon Series Bulletins Compiled

Three bulletins on the Merlon series of thermoplastic resin dispersions for producing durable finishes and coatings without curing in textile applications have been compiled by the textile chemicals department of Monsanto Chemical Company's Merrimac Division.

The Merlon bulletins include a list of suggested uses, general properties, mechanical stability, film characteristics and specifications.

• Corley Appointed Manager

H. M. Corley has been appointed Manager of the Chemical Division of Armour and Company. He joined the company in 1927 and developed a widely diversified background in progressing through a number of positions with the company. He has been prominent in the high molecular weight aliphatic chemical field since 1935. Almost all of his work has been in the development of new chemicals, commercial processes for manufacturing these and new products in which these new chemicals are used. For the last three years he has been Assistant Director of Research, supervising new chemical developments.

In his new position, he will be responsible for chemical plant management and operation, chemical sales as well as chemical market development and market research on new items.

This appointment is expected to closely integrate the functioning of all departments and greatly accelerate the pace of chemical developments within the company.

• Joins Sales Staff

H. Alvin Rose has joined sales staff of Philipp Brothers Chemicals, Inc., covering the New York metropolitan sales area. Mr. Rose was formerly associated with the Heyden Chemical Company for 7 years, covering the New York territory.

A graduate of New York University, Mr. Rose is a member of the Chemical Salesmen Association.

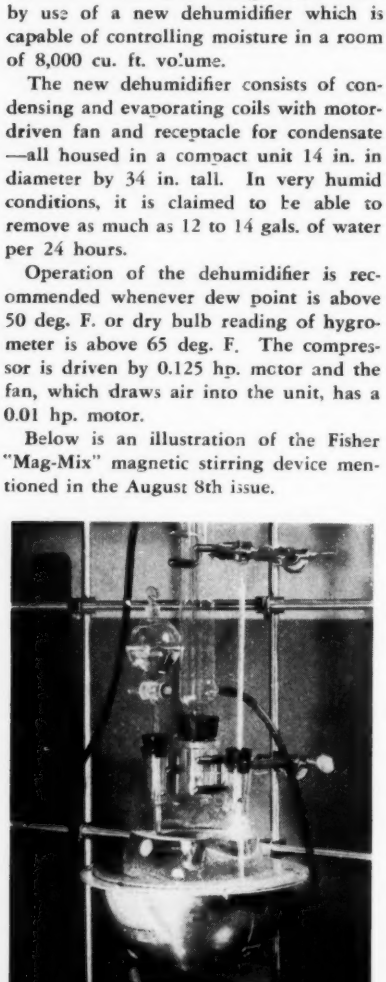
• High Humidity Elimination

High humidity—corrosive to laboratory equipment, objectionable in weighing deliquescent material and enervating to laboratory personnel—can be eliminated, it is claimed (Fisher Scientific Company, 717 Forbes Street, Pittsburgh 19, Penna.) by use of a new dehumidifier which is capable of controlling moisture in a room of 8,000 cu. ft. volume.

The new dehumidifier consists of condensing and evaporating coils with motor-driven fan and receptacle for condensate —all housed in a compact unit 14 in. in diameter by 34 in. tall. In very humid conditions, it is claimed to be able to remove as much as 12 to 14 gals. of water per 24 hours.

Operation of the dehumidifier is recommended whenever dew point is above 50 deg. F. or dry bulb reading of hygrometer is above 65 deg. F. The compressor is driven by 0.125 hp. motor and the fan, which draws air into the unit, has a 0.01 hp. motor.

Below is an illustration of the Fisher "Mag-Mix" magnetic stirring device mentioned in the August 8th issue.



Fisher "Mag-Mix"

• Customs House Guide

Drastically revised for the purpose of giving thousands of foreign traders throughout the United States and abroad the very latest possible information, the 1949 edition of the Customs House Guide (box 7, Sta. P., Customs House, New York 4, N. Y., Price $25.00 plus postage) is now off the press and in distribution, according to a statement by John F. Budd, editor and publisher.

More vital than ever before in its history of nearly nine decades, the latest edition of the Guide is the only publication in the world including the new United States import duties as provided in the General Agreement on Tariffs and Trade (Geneva), these rates appearing against each of the more than 30,000 commodities in the Alphabetical index. The official phrasing of the General Agreement appears under each paragraph effected in the section devoted to the Tariff Act of 1930. This is in addition to all President's Proclamations and changes by Acts of Congress.

"The newest edition of the Guide," said Budd, "is the only publication anywhere which brings up to date and under one cover all this new tariff information. It covers trade agreements with 41 nations, including the 21 nations involved in the General Agreement at Geneva."

The more than 1,600 pages of the Guide, which actually comprise seven volumes in one, feature in addition to the above, the Internal Revenue Code; Port activities, facilities, charges, and a directory for shippers and those in allied trades; special sections devoted to Canada and the Philippines; a General Information Section containing considerable valuable information for importers and exporters; and the United States Customs Regulations complete and revised to date.

To keep the Custom House Guide up-to-date, Budd publishes a monthly supplement, American Import and Export Bulletin, which covers the latest laws, regulations, decisions, rulings, import and export control requirements, trade agreements, general news, and business contract lists. In addition, a free Readers' Information Service for the benefit of subscribers is maintained.

Completing the overall pattern of his publications, the latest progress in domestic and foreign air commerce is recorded in the world's first and only air cargo magazine, Air Transportation; and Air Shippers' Manual, which is a specialized directory for use in traffic departments.

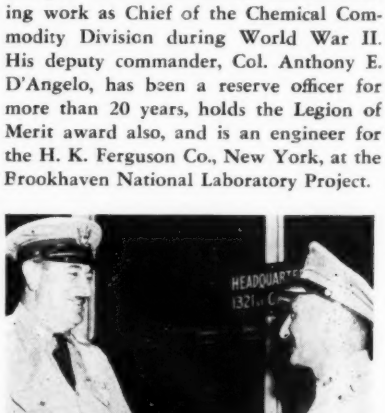
Budd, who is founder and honorary chairman of the Aviation Section, New York Board of Trade, also serves as a director of the National Association of American Importers, Inc.; and executive secretary of the Customs Brokers and Forwarders Association of America, Inc. He is said to have been largely responsible for the increasingly important part in air transportation being played by the foreign freight forwarder as well as the domestic freight forwarder.

• Chemical Corps Program

The first group of Chemical Corps reserve officers from the Greater New York Area inaugurated their new field training program during a recent three-day weekend at Fort Tilden, New York, July 23 to July 25. The unit, consisting of officers assigned to the 1021st ORASU, New York Chemical Procurement District, is under the leadership of Col. Samuel N. Cummings. Under the program, sponsored by the commanding general of the New York-New Jersey Military District, officers participated in their regular training schedules during "duty hours" and were able to enjoy the companionship of their families during the remaining weekend hours.

The 1021st ORASU is unique among Army units. Although it is composed entirely of World War II veterans, many with combat experience, its primary mission is not combat but efficient business operation. The purpose of the recent procurement training exercise was to orient the reservists on the operations and staff functions performed by officers of a Chemical Corps procurement district.

Commanding officer of the unit is Col. Samuel N. Cummings, president of Pylam Products Co., New York, holder of a Legion of Merit award for his outstanding work as Chief of the Chemical Commodity Division during World War II. His deputy commander, Col. Anthony E. D'Angelo, has been a reserve officer for more than 20 years, holds the Legion of Merit award also, and is an engineer for the H. K. Ferguson Co., New York, at the Brookhaven National Laboratory Project.



Col. Anthony E. D'Angelo, left, and Col. Samuel N. Cummings

• ITT Member Honored

T. L. W. Bailey, Jr., fiber microscopist at the Institute of Textile Technology, was among the 20 employees and former employees of the Southern Regional Research Laboratory, New Orleans, La., who received one of the Department of Agriculture's highest honors recently. The group of 20 was presented with a superior service award for outstanding contributions to the development of improved types of cotton tire cord.

Three accomplishments of the group receiving the award have attracted widespread interest. These are a new type of cord stretching machine which produces a more uniform cotton tire cord; a new cord construction which gives higher resistance to fatigue, thus lengthening the useful life of the cord; and new types of tests and testing equipment which provide increased knowledge about the fundamental properties of tire cord. Mr. Bailey was concerned with the microscopical analysis and evaluation of the effects of the treatments.

Dr. Helmut R. R. Wakeham, who was on the Institute staff for a number of years, was also among the group to be honored.

• New Chlorine Bulletin

A new edition of their Technical and Engineering Service Bulletin No. 7, *Liquid Chlorine,* has been announced by the Solvay Sales Division, Allied Chemical & Dye Corporation. This is the second edition of the bulletin that was issued several years ago and contains the latest information on the properties of chlorine, chlorine containers, equipment and accessories, instructions for safe handling and procedure in case of leakage or accident. This 60 page bulletin is fully illustrated with tables, charts and diagrams.

Copies of Bulletin No. 7, *Liquid Chlorine,* are obtainable without charge by writing the Solvay Sales Division, Allied Chemical & Dye Corporation, 40 Rector Street, New York 6, N. Y.

• Helmus Named Consultant

Weldon Helmus, executive of the Fair Lawn Finishing Co., has been named textile consultant for the North Jersey Industrial Exposition to be held Oct. 1 to 8 at the National Guard Armory in Paterson, N. J., under direction of the Greater Paterson Chamber of Commerce.

The Exposition, focusing attention on the widely diversified products made in this area, is aimed at broadening markets by acquainting buyers, retailers and the general public with production sources.

• New Casein Fiber

A new curled casein fiber is now being used where the resiliency of horsehair previously had been uniquely suitable. The new fiber, known as Caslen and used as a single filament a few thousandths of an inch thick, is cheaper than the best quality horsehair, equally resilient, and much more dependably uniform and available. The process was suggested by work of the Department of Agriculture, and was developed for these applications by Arthur D. Little, Inc., and the Rubberset Company, which is now producing Caslen.

Casein, obtained from skim milk, is one of the proteins, as are wool, horsehair, and human hair. When "regenerated" in fiber form it will take a permanent curl which gives a mass of fibers a springy quality. Curled Caslen is now used in a new automotive air filter made by Fram Corp.; here the Caslen blended with wool filters dust from the air entering the carburetor. The filter unit can be used in old cars as well as new, and can be replaced more easily than the oil in conventional filters can be renewed. Mattress and furniture manufacturers are experimenting with Caslen as stuffing; in an uncurled form which is also available it may be blended into textiles to produce novel effects.

The horsehair which has been used primarily as stuffing comes chiefly from Argentina, where wild horses are rounded up each year and their manes and tails are cut. After the raw hair arrives in the United States, it is curled by a laborious hand process. A ropelike roving, about 80 feet long, is softened by steam, wound tightly, and then hung for about six months to set the "permanent wave." When it is torn apart, the intertwined hair makes a soft springy bat. The supply and quality of horsehair fluctuates, and there are indications that the supply is *diminishing.* About two and a half million pounds were imported in 1948 and sold at $1.25 to $1.40 a pound.

The curled casein monofilament is now selling for 94 cents a pound, but the price may decline as production increases and the price of dry casein drops. During the war, skim milk was used widely in dried form for human feeding. As foods become more abundant and cheap and surpluses become a problem, the casein market may help to stabilize farm income to some extent.

When skim milk is solidified by hydrochloric or other acids, the casein settles out as a curd, similar to that obtained when milk sours naturally. The casein is dried, water is added, it is heated, and forced through fine jets. The resulting filament is hardened in a tanning agent such as formaldehyde, curled, and dried to a permanent set.

Besides its favorable price position, the curled casein is uniformly clean, the diameter and length of the staple are controllable, and it is believed to be non-allergic. Cleanliness is a particularly important point for mills handling large quantities of fiber, for the natural materials are often heavily contaminated. The filament may also be treated to make it mildew-, moth-, or bacteria-proof. The success of the new product as an improvement over natural horsehair is expected to give impetus to the whole field of filaments and textiles from regenerated proteins.

• Metalsmiths Batch Cans

Stainless steel batch cans of welded construction are now being made by Metalsmiths, Division of Orange Roller Bearing Co., Inc., 560 White St., Orange, N. J. These are said to be made of type 304 stainless steel, butt welded construction by the heliarc process using no filler rod or flux. They are reinforced at the top by an endless iron ring, with handles attached and with an iron chime; the metal is flanged out over the edge of the top band and for ¼" down on the outside. The bottoms are reinforced by an iron cross welded to the chime. They are available from stock in 10 to 75 gal. sizes, with or without covers, and are also made in other analyses stainless, Monel, Inconel and pure nickel. Other Metalsmiths corrosion resistant materials handling utensiles include pails, dippers, measures, scoops, shovels, dye buckets, funnels, beakers, stock pots and storage tanks.

• Dr. Cullen to Address DCAT Meeting

Dr. Frederick J. Cullen, Executive Vice President of the Proprietary Association of America, will address the DCAT at its 59th Annual Meeting to be held at Shawnee Inn, Shawnee-on-Delaware, Pa., Sept. 22-24.

Fred J. Stock (V. P., Chas. Pfizer & Co.), Chairman of the Business Program Committee for the Shawnee Meeting, announces: "Dr. Cullen will be the sole speaker at the business session scheduled for Friday afternoon, September 23. Under the title of 'Trends in Government', he will discuss those activities of the Federal agencies most vitally affecting the drug, chemical and related industries and present up-to-date information on such matters as compulsory health insurance, etc."

Mr. Stock continued: "This will be a most important business session, as all of the business of the annual meeting will be transacted at this time, including, the annual reports of officers and committee chairmen and the election of an executive committee."

• New Superintendent at Maneely

Maneely Chemical Co. announces the appointment of Morgan Jones as superintendent of their plant at Wheatland, Pa.

Mr. Jones was graduated as a Chemical Engineer from the Ohio State University where he was a member of Phi Delta Theta, Tau Beta Pi, and editor of "Ohio State Engineer," the engineering college magazine. Mr. Jones comes to the Maneely Chemical Co. directly from the Calco Chemical Div. of American Cyanamid Company at Marietta, Ohio, where he has been Production Superintendent since 1945.

• New Diluter and Feeder

% Proportioneers, Inc. %, 9-93 Codding St., Providence, R. I., has issued literature in the form of illustrated and descriptive bulletins on two of their products, namely their automatic caustic diluter and their new 47 Series Heavy Duty Chem-o-feeder. The latter is a diaphragm pump, usually equipped with a "see-thru" plastic reagent head and driven by a 1/6 H.P., 1725 RPM electric motor. The feed rate is manually adjustable while the unit is in motion by means of a stroke adjusting knob. The feeding rate is also manually adjustable by changing the position of the belt on a three-step cone pulley. Other features include an arrangement whereby all moving parts are enclosed in an oil bath and another by which the actual injection of fluid chemicals takes over the major portion of the pumping cycle. It is said to be accurate and dependable, as well as universally applicable in feeding a large variety of liquids and slurries below 100° F.

The bulletin describes still other features, stroking rates, discharge rates and range as well as supplying information on proportional control and chemicals handled by the Chem-o-feeder. (Bulletin SAN-7).

The automatic caustic diluter lays claim to simplicity, accuracy, automatic control and wide range. Only a single control wheel is used to change the concentration and govern final caustic strength. Reference to a dilution chart is said to enable the operator to select proper concentration and set the odometer type indicator to setting for correct concentration. Changes in concentration, it is said, may be made while the equipment is in operation. Accuracies are claimed within ± 1½% at all flows within the range of the equipment. The diluter is said to operate accurately over a 10 to 1 range. Various sizes of diluters are available to cover all demands less than 1 GPM to over 200 GPM strong caustic. Once the equipment is started and set for the proper dilution, the unit, it is claimed, will respond to any and all changes in demand over the entire range without having to adjust any part of the unit.

Charts, tables, explanations of same, a flowgram, and a discussion, "The Why ??? of Continuous Dilution" are also contained in the bulletin describing the features of the diluter.

• New Dehumidifier

A new, large capacity, semi-portable dehumidifying unit that operates on a refrigeration principle has been placed on the market by Carrier Corporation as the result of the demand created by an earlier model introduced in 1948.

Built around a one-third horsepower condensing unit, which gives several times the capacity of other models now on the market, the new 53F Carrier "Humidry" is said to have a capacity for removing 34 pints of moisture per day under room conditions of 80 degrees and 70 per cent relative humidity. Under even more severe humidity conditions, government tests are said to have shown it to take as much as 50 pints from the air per day.

The new model has been designed to be safely installed in any convenient location and, it is claimed, requires merely an electric plug-in connection—110 or 230 volt 60 cycle AC—and a floor drain for moisture disposal.

It has proven to be of immense benefit to tradesmen where rust, mildew, mold, or rot cause damage, deterioration or work delay. It is said to be suitable for application wherever high prevailing humidities present a marked goods spoilage problem and halt work progress due to drying problems.

In the Carrier Humidry, the warm, humid air is drawn over the chilled surface of the copper plate fin type evaporator, dehumidifying coil and moisture from the air is condensed, collected on the coil and drained away.

The cool air then passes over the warm condenser surface by forced circulation from the pressed steel fan and is recirculated around the room.

Humidry's heavy duty one-third horsepower motor, in continuous operation, is said to gradually reduce the moisture content of all air in the enclosed space.

Other features include a receiver of heavy steel, hydrogen brazed and equipped with integral liquid shut-off valve. An expansion valve is said to regulate the flow of the refrigerant automatically as it flows to the cool coil, while the drain pan collects moisture as it is removed from the evaporator coil for disposal to the open floor drain.

Cabinet dimensions are 18 inches long x 15 inches wide x 12 inches high. Net weight is 125 pounds.

• Fire-Retardant Coatings for Aircraft

As the result of a joint research program underttken by the National Bureau of Standards and the Civil Aeronautics Administration, coatings have been developed for fabric-covered aircraft which approximately double the time interval between ignition of the fabric and its destruction by fire. These findings, based on both laboratory and wind-tunnel burning tests conducted by S. G. Weissberg, H. L. Hansberry, and G. M. Kline, provide a basis for more effective extinguishment of fires in flight, particularly those arising from power plants in small craft. In designing the coatings, the peculiar requirements of aircraft use made it necessary to consider not only fire-retardant effectiveness but also aerodynamic smoothness, adhesion, flexibility, effect on tautness of the substrate dope, application characteristics, durability, and resistance to gasoline, oil, and ethylene glycol.

The materials which have been used most successfully in fire-retardant coatings include film-forming substances and pigments which in burning give off large quantities of noncombustible gases; substances which exclude oxygen by forming an impenetrable protective glaze; and compounds which absorb the heat of the flame through endothermic changes.

The evidence presented by the wind-tunnel tests showed clearly that it is possible to increase the time for fabric destruction from the six seconds characteristic of cellulose acetate butyrate to about 12 seconds. Some additional improvement can be achieved, it is claimed, by designing the outer coating to have greater mechanical strength after burning so that it will not be blown away so easily by the wind stream.

For more complete details, see Fire-retardant coatings for fabric-covered aircraft, by S. G. Weissberg, H. L. Hansberry, and G. M. Kline, Ind. and Eng. Chem. *41*, 1742 (1949).

• Foxboro Exhibit

The advance of Instrument Engineering, as evidenced in the development of new or improved instruments and auxiliary equipment, will be featured in the exhibit of The Foxboro Company, Foxboro, Mass., at the Fourth National Instrument Conference and Exhibit, being held in the Municipal Auditorium, St. Louis, Mo., September 12 to 16 inclusive. Foxboro will occupy Booths 512-516. A large number of the company's engineers will be in attendance throughout the week. Wherever possible, the instruments displayed will be shown in simulated operation.

• Simplified Softener Installations

An example of research applied to cutting production costs is claimed to offer sizable economies for those engineering firms which install ion exchange units for low-cost softening of domestic water supplies and process and boiler-feed waters.

Resins used in these softening installations are housed in columns or tanks. Hitherto, engineering companies which commonly specify, design, and install these units are said to have needed to stock several hundred shell heights, each with several diameters. To provide for a given capacity under widely varying conditions of flow rate and water impurity, these companies have found it necessary also to vary bed depths or cross-sectional flow rates, adapting these variables arbitrarily between the strict limits which the standard shell dimensions imposed. In some cases, the quality of the treated water was stated to have suffered because of these modifications.

Recently, however, researchers in the Resinous Product Division laboratories of the Rohm & Haas Company have claimed that several of the Amberlite exchangers can be mixed judiciously to obtain a wide range of capacities within a given fixed-bed volume. By combining two sulfonic acid exchangers in proper proportions, it is now possible to achieve a wide range of results, matched accurately to the amount of undesired solids to be absorbed and to the purity of effluent required. At the same time, this mixing of resins is said to permit the equipment manufacturing company to reduce considerably the variety of shell sizes it must stock; to reduce or even eliminate drawing expense and bill-of-material changes; to process orders rapidly; streamline production; and simplify the line of softeners for the benefit of sales representatives.

It is claimed further that the method involves no sacrifice due to attrition such as normally occurs when products of differing hardnesses are mixed. After a 30 to 40 mesh cut of the mixtures had been rotated in water for one week at 30 rpm, examination for resin passing 40 mesh is said to have showed no material increase in attrition. In addition, it is stated that individual hydraulic characteristics of the exchangers were not markedly affected by mixing.

• Textile Research Institute

Dr. Helmut Wakeham, well known for his researches on cotton fibers, has accepted a position as Section Head in the Princeton laboratories of Textile Research Institute, it has been announced by Dr. J. H. Dillon, Director of Research. Dr. Wakeham received his undergraduate training at the University of Nebraska and pursued graduate studies at the University of California, which institution awarded him the Ph. D. degree in physical chemistry in 1939.

In 1947 Dr. Wakeham joined the staff of the Institute of Textile Technology in Charlottesville, Virginia. He resigned on June 1 from that position to accept the post of Section Head in charge of cotton fiber studies with Textile Research Institute. His work will tie in closely with that of Professor John C. Whitwell, who has recently claimed that the cotton cellulose molecule is degraded seriously by mechanical processing. The importance of this work is receiving the enthusiastic interest of cotton mills and textile machinery manufacturers alike, since it offers hope of extending the life of the cotton fiber by increasing launderability and fatigue resistance of cotton fabrics without increase in materials cost.

In accord with the Institute's policy, Dr. Dillon also announced that Dr. Richard O. Steele has elected to continue as a staff member. Dr. Steele graduated with a B. S. degree from the University of North Carolina in 1942, and thereafter had 3½ years of experience in the textile chemicals industry. He received his Ph. D. degree in organic chemistry from Princeton University this June after being a Research Fellow of Textile Research Institute for three years, the last year as Avondale Mills Fellow. His studies will correlate closely with those of Dr. Wakeham as well as with the internationally known work of Professor Eugene Pacsu of The Textile Foundation staff.

Messrs. Paul B. Stam and Charles H. Reichardt have also decided to accept invitations to join the Institute staff, but have postponed their final oral Ph. D. examinations at Princeton until September in order to concentrate on pressing research during the summer months. Both are physical chemists. Mr. Stam's work has been on the swelling characteristics of fibers and now is directed toward the use of radioactive tracer elements to elucidate dyeing phenomena. Mr. Reichardt has made several contributions to our knowledge of the mechanical behavior of fibers. The T.R.I. Fiber Tester developed by Mr. Reichardt is already in use in several T.R.I. member mill laboratories. His present and future program is a study of the effects upon fiber properties of topochemical reactions designed to give mildew resistance, flame resistance, and water repellency.

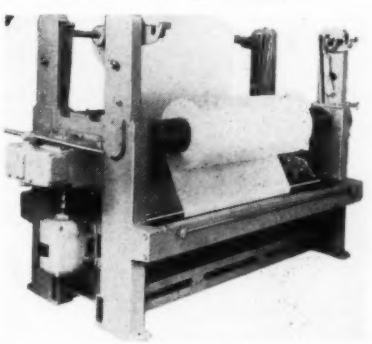
The Institute's cooperative program with Princeton University continues to be successful, according to Dr. Dillon. It has already produced six Ph. D.'s and one M. S. graduate from Princeton with thesis research in textile sciences. Four more Ph. D. degrees will be granted in September. Four new Textile Research Institute Research Fellows have been appointed—Edward T. Kubu, B. S., New York University; Albert W. Bauer, B. A., Gettysburg College; Richard G. Quynn, B. S., College of William and Mary; and Warren T. Milloway, B. Ch. E., North Carolina State. Mr. Kubu starts his work with Professor Arthur V. Tobolsky on the international Wool Project on July 5. The others report in September. Messrs. Quynn and Milloway received further training at the Institute of Textile Technology in Charlottesville before transferring to Textile Research Institute and Princeton University. Dr. Dillon points out that two other Research Fellowships are unfilled but, until outstanding men can be located, they will remain so. This is in spite of numerous applications for the two unawarded fellowships. T.R.I. Research Fellows must be of a calibre to fulfill the basic requirements of T.R.I. Fellowship policy—"to produce textile research in the present and textile research men for the future."

• New Van Vlaanderen Dye Jig

Van Vlaanderen Machine Company of Paterson, New Jersey, has announced a new dye jig with an entirely new drive unit and other features which the company states will be advantageous in dyeing nylon and other modern fabrics.

For quality jig dyeing each type of the new fabrics requires an ideal tension and the maintenance of that tension by a close margin is important. The new jig is said to maintain the desired tension by the use of a worm-gear drive immersed in oil and separated by a partition from the dual friction clutch which operates dry. This new drive, plus anti-friction bearings, is said to greatly reduce drag when idling.

Other improvements claimed are: totally enclosed sprockets and chains, sealed in oil for longer service and cleaner operating conditions; new overflow arrangement at sides to keep scum from fabric; and quick replacement of main drive unit with a spare unit when necessary with the minimum loss of production.



Van Vlaanderen Dye Jig

• Trianized Heat-Setting Process Introduced

A new heat-setting process to give warp-knit fabrics uniformity and stability was recently announced by the Triangle Finishing Corp., Johnstown, New York. Fabrics processed by this method will be known as "Trianized" nylon tricot.

Nylon tricot or warp-knit fabric is automatically fed to a pin tenter and run through a hot air chamber at far higher temperatures than before in use. The process is carried out on new equipment especially built for this operation which is said to make it possible for the first time to secure uniformity of heat and air flow and to control with precision the uniformity of tension and width and length of the fabric. The Trianizing process takes advantage of the fact that at very high temperatures, just below the melting point, nylon fabrics can be reshaped and reformed. It is stated that it is unnecessary to allow complete shrinkage during processing; in fact, yields can be increased with less residual shrinkage remaining in the finished fabric than with other methods. It is further stated that all physical characteristics of Trianized fabrics may be controlled at selected levels resulting in uniform width, color and texture.

A. J. Nisbet, President of Triangle Finishing Corp., stated that results obtained during a full year of construction and testing reveal that by this process knit goods are now for the first time in a class with woven goods as far as uniformity of width and dimensional stability are concerned. Mr. Nisbet also stated that the experience of manufacturers of women's underwear who have cut initial deliveries indicates a gain in cutting efficiency of at least 10% without fabric waste, as a result of improved uniformity alone.

Shrinkage and yield results obtained with 40 denier nylon tricot fabrics over the past several months are said to show an 8% gain in yield with shrinkage under 2% in both length and width. Results on other constructions are said to show even greater gains in yield with a reduction in shrinkage of over 50%. It was further claimed by Mr. Nisbet that besides imparting uniformity and stability to nylon tricot and other warp-knit fabrics, the process minimizes relaxation and distortion, at the same time not losing the other desirable characteristics of warp-knit fabrics.

Greater color uniformity is claimed not only in the elimination to a large extent of the dyeing difference between one end of a piece and another but also in reconciling the differences in shade between different pieces. Initial tests under actual cutting conditions were said to show that larger dye batches or combinations of several batches may be cut together without segregation.

Experiments with the Trianized process on other fabrics are in progress. It is stated that nylon combined with other synthetic and natural fabrics can be successfully Trianized. Spun nylon fabrics may also be Trianized. It is also claimed that, in addition to the improvement in stability and uniformity coupled with lack of relaxation or distortion inherent in Trianized warp-knit fabrics, they also emerge from the process with a permanently improved texture which gives a more pleasing and fuller hand.

As a result of the process it is anticipated that many new important apparel uses for warp-knit fabrics will be possible. Nylon tricot which has been confined to women's lingerie, and lately in blouses and negligees, is currently being featured for women's daytime and evening dresses, sports clothes and children's apparel. It has also attained widespread interest in men's sports shirts and underwear.

Among the first Trianized fabrics on the market are those being distributed by Philip Wick Company nad associated companies. They are the NylA-Q nylon tricot fabrics for general apparel purposes and industrial uses.

• Non-woven Cotton Felt

A felt made entirely of cotton which is expected to bring some radical changes in the textile field has been discovered by the research staff of Kendall Mills, Walpole, Mass. It is to be known as Webril Non-woven Fabric Type R, and is said to contain no wool or animal fibers. The fabric is held together without binding agents.

The fabric is expected to affect the manufacture of artificial leather, plastics, surgical dressings, batteries and filters. It also is said to have consumer applications for businesses and homes as yet not fully explored. Kendall has applied for the patents.

The ability to felt, as it has been known, is an exclusive natural property of some animal fibers. Until Kendall scientists invented Webril R it had been stated that a true felt made wholly of cotton was impossible to produce. Webril R is said to simulate nature's fiber structure in animal wool and real leather.

Since the 1860's patents have been obtained on non-woven fabrics, but all of these contained adhesives as a binder to hold the fibers together. The new non-woven cotton felt is said to be held together solely by an elaborate entangling process which eliminates weaving and spinning, giving Webril R surprising strength and freedom from linting. At the same time the product is claimed to be soft, flexible and comformable.

One of the most promising applications for this new material is in the manufacture of artificial leather. When impregnated to increase its strength and surface-coated for appearance, Webril Non-woven Fabric Type R is said to possess a combination of natural texture and leather-like "hand" which strikingly resembles the fiber structure of genuine leather, an achievement never before attained in an artificial leather. The suede-like character of the reverse side and clear raw edges are said to allow fabrication by methods used in real leather.

Kendall Mills will supply the basic fiber structure to manufacturers for further processing into materials for shoe linings, luggage, women's handbags and other items.

The lint-free aspect of Webril R may aid in surgical felts for brain and nerve surgery. It can be cut into any size and shape, it is claimed, with no threads to fray. The pure cotton fibers are said to make it safe and absorbent with high retention of fluids.

Preliminary tests in filtration indicate that Webril R may also be an effective filter medium.

• Sodium Booklet Published

National Distillers Chemical Corporation, Department A, 120 Broadway, New York 5, N. Y., announces the publication of a 50-page booklet on sodium, its reactions and industrial uses. Believed to be the most complete review of the element since it was first isolated by Sir Humphrey Davy in 1807, the brochure is said to contain many pertinent equations and an extensive bibliography listing 304 references to articles and patents. Its table of contents includes such sodium topics as: history, handling and storage, properties, industrial applications and chemical reactions.

The corporation is now constructing a $10,000,000 plant, with a rated capacity of 100,000 pounds of sodium a day, in Ashtabula, Ohio. The plant, it is said, will be in production by April, 1950.

OBITUARY

GEORGE K. KITTLE

George K. Kittle, former salesman of the N. Y. Office of the General Dyestuff Corporation, 435 Hudson Street, New York 14, N. Y., died at his home in Glenbrook, Connecticut, July 28, 1949. Born March 23, 1873, he spent most of his early years in Pittsfield, Mass. He joined Kuttroff, Pickhardt & Company, New York, on March 1, 1901, and retired January 1, 1941. In addition to a large clientele in the textile trade in New York State he serviced the carbon paper and typewriter ribbon industries. He leaves a host of friends, both among the trade and his business associates.

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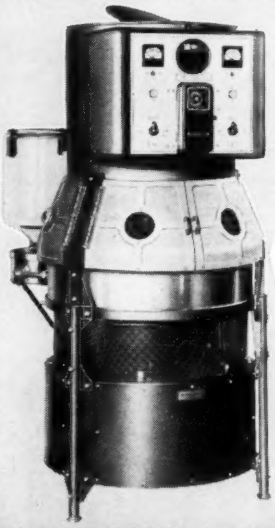

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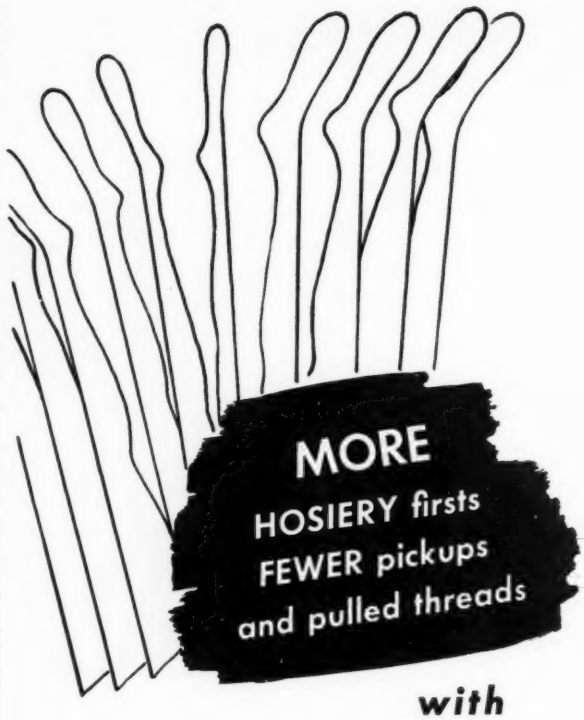

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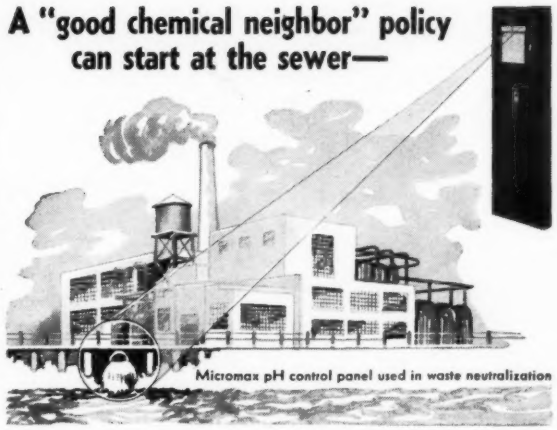

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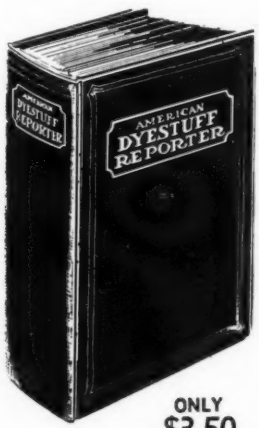

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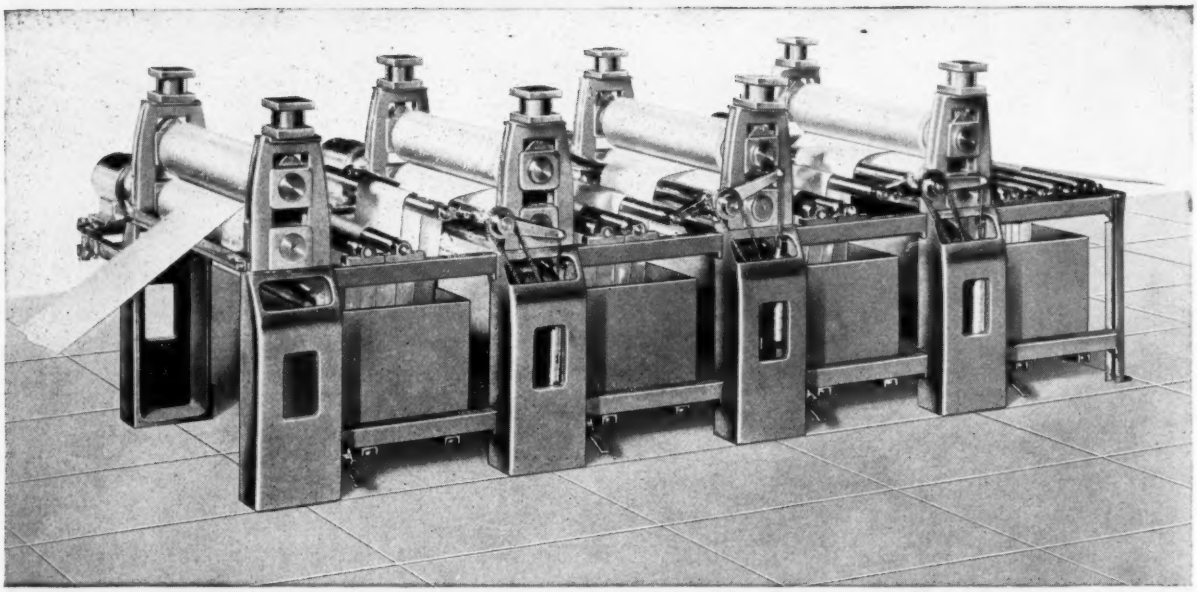

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